

World Congress "Climate Change and Its Effects" CCIE-2025



6-8 September 2025



Souvenir Cum Abstracts/Proceedings Book



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Climate Change and Its Effects (CCIE-2025)

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POKHARA UNIVERSITY
उप-कुलपतिको कार्यालय
OFFICE OF THE VICE-CHANCELLOR



चलानी नं.: /Ref. No.

Message from the Vice Chancellor

It is my pleasure to welcome you and address the World Congress on Climate Change and Its Effects (CCIE 2025) from 6 to 8 September 2025, hosted by Central College, Kathmandu (affiliated to Pokhara University). We have gathered here not just as general participants, but as change makers by sharing knowledge and experience in the field of Climate Change and its unprecedented consequences. Your presence signifies a shared dedication to collective responsibility for ensuring the life on earth in the changing scenarios of ecology and environment. Continuous emission of greenhouse gasses and subsequent global warming has been causing climate chaos. Hence, we stand at a critical juncture in human history. The evidence of our changing climate is no longer a distant forecast whereas a present reality felt in the melting glaciers of our Himalayas, the unpredictable monsoons across our farmland, and the growing frequency of extreme weather events that disrupt lives and livelihoods. This is not a challenge for a single nation or a single discipline; rather it is a global crisis that demands a global and truly interdisciplinary response.

This congress unites minds from agriculture, environmental science, geography, technology, and public policy across Nepal, India, Turkey, and beyond. This is the spirit we seek and need to understand and tackle the climate change. When academia, research institutions, and societies such as AETDS work together real solutions take shape. We must move beyond inaction based discussions. Hence, we have to forge integrated strategies that are scientifically sound, socially just, locally actionable, and scalable.

As being the educational and research leaders, our role is collective. We are the architects of future innovation and the mentors of the next generation of problem solvers. This congress is a catalyst to share rigorous evidence to challenge outdated paradigms, parameters in order to build partnerships that can translate ideas into practice. Let our work advance nature based solutions, resilient infrastructure, climate smart agriculture, responsible finance for adaptation and mitigation, and the ethics and equity that must guide every decision. I urge every participant, whether a seasoned researcher, a passionate student, a practitioner, or a policy maker, to engage deeply for minimizing the impact of climate change. Let our discussions be bold, our conclusions clear, and our resolutions strong. Let us leave Kathmandu with new knowledge and with a shared commitment and a concrete plan of action that can be measured, refined, and expanded over time by arousing awareness from the laymen to politicians who are serious about climate issues, particularly the sustainability of good environment and ecology.

Pokhara University stands hand in hand to support this mission to save our future generation and species on earth. I extend heartfelt congratulations to Central College, AETDS, and all collaborating universities and institutions for convening this vital gathering. I thank the keynote speakers, presenters, reviewers, session chairs, sponsors, and volunteers for their dedication. Let the ideas shared here inspire action, let the breakthroughs challenge the inaction of policy makers and let our collective commitment ignite real-world challenge of climate crisis. I am confident that CCIE 2025 will be a landmark in our shared effort to build a sustainable and resilient planet.

I wish all the success of the congress.

Prof. Bed Raj KC, PhD
Vice Chancellor, Pokhara University, Nepal



कृषि तथा वन विज्ञान विश्वविद्यालय
उपकुलपतिको कार्यालय
Agriculture and Forestry University
Office of the Vice Chancellor
Rampur, Chitwan, Nepal

Date: 29 August 2025

Message from the Vice-Chancellor

It is with great pleasure that I extend my greetings for the World Congress on “**Climate Change and Its Effects (CCIE 2025)**” organized by the Agricultural and Environmental Technology Development Society (AETDS) in collaboration with Directorate of Research and Extension and Faculty of Agriculture of Agriculture and Forestry University, Rampur, Nepal; Institute of Agriculture and Animal Science, Tribhuvan University, Kathmandu, Nepal; Department of Agriculture, Kathmandu University, Nepal; National Agronomy Research Center, Nepal Agricultural Research Council, Kathmandu, Nepal; Central College, Kathmandu, Nepal; Department of Geography, D. S. B. Campus, Kumaun University, Nainital, India; Sandip University, Madhubani, Bihar, India; University of Cukurova, Türkiye, from **6-8 September 2023**.

The theme of this conference addresses one of the most urgent and serious challenges, especially in our agro-ecology, at this time. Climate change poses a profound threat to global socio-economic development, and addressing it requires concerted and multisectoral effort. This platform will bring together researchers, academics, professionals, and students from national and international institutions to share ideas, present research findings, and collaborate to formulate effective solutions. It is a crucial step in fostering university-industry partnerships to tackle these pressing global issues.

I am confident that the sharing of innovative research, ideas, and experiences across the conference's sub-themes will make a critical turning point in developing scientific and practical strategies to mitigate the ongoing challenges of climate change.

I commend the organising committee for their hard work in putting this significant event together. Additionally, I would like to express my gratitude to the esteemed keynote speakers, academicians, researchers, and all participants for their invaluable contributions in the form of papers and abstracts.

I wish the organizers and all delegates a productive and successful conference.

Prof. Sharada Thapaliya, PhD

Vice- Chancellor



SANSKRITI
UNIVERSITY
FOR EXCELLENCE IN LIFE

Dr. M.B. Chetti

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Former Vice Chancellor

University of Agril. Sciences, Dharwad

Former Asst. Director General (HRD)

ICAR, New Delhi

Message

It is a matter of great pride to be associated with the World Congress on Climate Change and Its Effects (CCIE-2025) being organized at Central College, Kathmandu, Nepal from 6-8 Sept 2025. It gives me immense pleasure to extend my heartfelt greetings to all participants, dignitaries, researchers, and delegates attending this World Congress. Climate change is one of the most pressing challenges of our era, demanding collective wisdom, innovative research, and sustainable solutions. Climate change is not just a scientific or policy challenge; it is a call to humanity to rethink the way we live, consume, and coexist with nature. This congress is expected to provide a significant platform for global experts, academicians, policymakers, and industry leaders to exchange knowledge, deliberate upon critical issues, and explore pathways towards a resilient and sustainable future. Let us carry forward the spirit of collaboration from this platform to ensure that our planet earth remains safe and vibrant for generations to come.

I am confident that the discussions, presentations, and collaborations emerging from this esteemed gathering will inspire actionable strategies and foster a spirit of shared responsibility to safeguard our planet for future generations. I also congratulate the organizers for their dedicated efforts in convening this meaningful event and for bringing together a global community united in purpose. May this congress serve as a milestone in strengthening our commitment to environmental stewardship and sustainable development.

I wish the congress every success in achieving its noble mission.

Dr. M. B. Chetti
Vice Chancellor



Message from the Vice Chancellor



It gives me immense pleasure to extend my greetings and best wishes to the organizers and participants of the **World Congress on “Climate Change and Its Effects (CCIE 2025)”**, scheduled to be held from **6–8 September 2025 at Central College, Kathmandu, Nepal**.

Climate change is one of the most pressing global challenges of our time, impacting ecosystems, societies, and economies in profound ways. Academic forums such as this Congress play a crucial role in fostering dialogue, sharing research outcomes, and exploring sustainable solutions to mitigate and adapt to its wide-ranging effects. I am delighted that the **Department of Geography, Kumaun University, Nainital**, is collaborating as an **Official Partner Institution** in this prestigious international event. Such initiatives not only enhance the academic reputation of our University but also provide a vibrant platform for our faculty and researchers to engage with distinguished experts and institutions from across the world. I sincerely appreciate the efforts of the organizing committee, partner institutions, and collaborators for their dedication in curating a rich and meaningful program. I am confident that this Congress will inspire constructive discussions, promote interdisciplinary research, and strengthen global partnerships for a sustainable future. I extend my best wishes for the grand success of **CCIE 2025** and hope that all participants will carry back valuable knowledge, collaborations, and fond memories of this academic endeavour.

With warm regards,
(Prof. Deewan S. Rawat)
FNASc, FRSC, CChem (London)
Hon'ble Vice Chancellor
Kumaun University, Nainital



"WE ASPIRE TO INSPIRE"

CENTRAL COLLEGE

Affiliated to Pokhara University

Date: 4th September, 2025

Ref. No. :

Message from the Mr. Paras Shrestha

It is my great pleasure, pride and privilege to issue a message on the occasion of the conference on the global issue, topic "Climate Change and its Impact" commencing from 9 June and closing on September, 11 2025. In reference to the global issue of climate change, Central College felt it corporate social responsibility to initiate the collective responsibility for planetary health by calling for individual and global action to combat against the possible catastrophic consequences. Hence, we feel that it is being late to restore ecosystem with a view to build a sustainable future of every species on the earth.

Climate change has become the biggest challenge to the mankind creating huge impact on socio-economic development of any country. The scientific evidence is unequivocal: climate change is a threat to human well-being and the health of the planet. Hence, it is an open secret that any further delay in concerted global action will miss the brief, rapidly closing window to secure a livable future. Both living and non-living organisms and human beings are dependent on each other maintaining a balanced ecosystem. A disturbance in any of the categories will create chaos in the entire ecosystem and threaten the environment. Hence, climate change is the greatest threat to our existence *in our short history on this planet since nobody's going to buy their way out of its effects.*

This conference is the foundation platform where researchers, professionals, and students from different institutions and universities nationally and internationally are expected to come together to discuss such issues and related research outcomes for effective strategies to minimize the fatal consequences haunting and questioning our moral psychology and ethical responsibility towards the other. I firmly believe that this platform will also help to establish a harmonious collaboration between universities and industrial firms to address the current global issues. Further, I believe that the sharing of the outcomes of researches, articles, ideas, innovations, and experiences of different experts and researchers under different sub-themes will be a milestone for the meaningful solutions on the ongoing challenging issues of climate change.

I congratulate the organizing committee of the conference for being the part of organizer in the collective effort initiated in order to address the current global issues in reference to the sense of awakening of the collective responsibility.

Evidently, I would like to thank distinguished keynote speakers, academicians, researchers and participants for your valuable knowledge sharing and submitting constructive papers and abstracts for this conference.

Believe in the power of your own voice for the assurance of the health of biosphere.

I wish the conference a grand success!

Paras Shrestha
Managing Director/ Principal
Central College
Kathmandu, Nepal

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Agriculture and Forestry University
Directorate of Research and Extension
Rampur, Chitwan, Nepal

Message from the Director

It gives me immense pleasure to extend my warm greetings to all participants of the World Congress on *Climate Change and Its Effects (CCIE 2025)*, being held from 6 - 8 September 2025 at Central College, Kathmandu, Nepal. This prestigious international event, jointly organized by leading academic and research institutions of Nepal, India, Türkiye, and other countries, is a timely platform to deliberate on one of the most pressing global challenges of our time i.e. climate change.



The Congress brings together scientists, academicians, professionals, policymakers, entrepreneurs, students, and development practitioners from across the globe to share experiences, innovations, and solutions for building climate-resilient societies. With its wide array of themes ranging from climate-smart agriculture, food security, natural resource management, health and well-being, to entrepreneurship and innovation- CCIE 2025 offers a unique opportunity to explore holistic approaches for adaptation and mitigation.

I am confident that the technical sessions, invited talks, and networking opportunities will inspire constructive dialogue, encourage meaningful collaborations, and pave the way for sustainable strategies to address the multifaceted impacts of climate change.

On behalf of the Directorate of Research and Extension, Agriculture and Forestry University, I extend my sincere gratitude to the organizing partners, distinguished speakers, delegates, and participants for their valuable contributions. May this Congress not only advance scientific knowledge but also strengthen our shared commitment to safeguarding the environment and ensuring a resilient future for generations to come.

I wish for the grand success of CCIE 2025.

With warm regards,



Prof. Nirajan Bhattarai, PhD

Director

Directorate of Research and Extension

Agriculture and Forestry University, Chitwan, Nepal

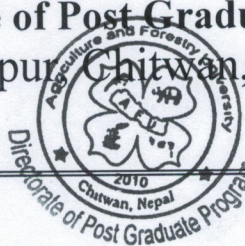
Director



Agriculture and Forestry University

Directorate of Post Graduate Program

Rampur, Chitwan, Nepal



Date: Sept. 1, 2025

Message from the Organizing Convener

It is my great honor and privilege to welcome all distinguished delegates, researchers, academicians, professionals and students to the World Congress " Climate Change and Its Effect (CCIE 2025)" being held from 6th to 8th September 2025 at Central College, Kathmandu, Nepal. This prestigious Congress is being jointly organized by Faculty of Agriculture and Directorate of Research and Extension, Agriculture and Forestry University, Rampur, Nepal; Central College, Kathmandu, Nepal; Department of Agronomy, Kathmandu University, Nepal; National Agronomy Research Center, Nepal Agricultural Research Council, Kathmandu, Nepal; D. S. B. Campus, Kumaon University, Nainital, India; University of Cukurova, Turkiye; and Agriculture and Environmental Technology Development Society (AETDS), U. S. Nagar, India.

CCIE 2025 provides a global platform to the critical challenges of climate change and its wide ranging impacts on agriculture, natural resources, biodiversity, food systems, water security and overall livelihoods. With nine major themes and several subthemes, the Congress will foster meaningful discussion, multi-sectoral collaboration and development of innovative mitigating and coping strategies for changing climate.

On the behalf of the organizing committee and our collaborating partner, I extend my heartfelt gratitude to all participants, contributors and supporters for this Congress. Your presence and active involvement will contribute towards building a more sustainable and climate resilient future, which saves the livelihoods of millions of families in this ecology.

I warmly welcome you all to Kathmandu, a historical city of South Asia, for this important gathering and wish you a productive and memorable experience at CCIE 2025.

Prof. Santosh Marahatta, PhD

Director, Directorate of Post Graduate Program

Director

Organizing Convener, World Congress " Climate Change and Its Effect (CCIE 2025)"



**UNIVERSITY OF ÇUKUROVA,
FACULTY OF AGRICULTURE,
DEPARTMENT OF SOIL SCIENCE and PLANT NUTRITION**



Message from the Congress Executive Director

World Congress on Climate Change And Its Effects (CCIE-2025) Distinguished Participants, Esteemed Scholars, and Stakeholders

Climate change and its effects rank among the most urgent and multi-layered global challenges of our time. Transformations in the climate system and the destructive impacts they trigger reinforce one another, thereby giving rise to problems of greater scale. In particular, rising temperatures associated with climate change, shifts and irregular fluctuations in precipitation regimes, increases in the frequency and intensity of extreme weather events, deteriorations in soil and water quality, and the deepening of biotic/abiotic stresses are exerting transformative impacts on water, energy, health, and ecosystem services—most notably on agriculture.

In this context, the World Congress on Climate Change and Its Effects (CCIE-2025) offers a unique platform for bringing together researchers from diverse disciplines, students, policymakers, and industry representatives to discuss evidence-based solutions and to share up-to-date research findings and good practices grounded in ecological principles. The Climate Change and Its Effects (CCIE-2025) Congress will be held at Central College, Sinamangal-9, Kathmandu, Nepal, on 6–8 September 2025, in collaboration with eight institutional partners. It is our great pleasure to be among you, representing Çukurova University. We have been closely following these congresses, which have been held regularly for the past several years, and we have been participating extensively. The way in which the congresses continually improve each year, consolidating and disseminating knowledge through the growing participation of scholars, provides important contributions in many respects. We are pleased to observe that our collaborating researchers attend these congresses to present their work, prepare their data for publication in accordance with scientific standards, and that these processes in turn stimulate new project ideas.

This multi-institutional structure enhances university–industry–public cooperation, enabling the development of strategies that both improve short- and medium-term adaptation to climate variability and mitigate the long-term adverse effects of climate change on agriculture and soils. The global warming driven by rising atmospheric greenhouse gases, which began with the transition from agrarian to industrial society, has led to ecosystem degradation and declines in agricultural production. Worldwide losses in agricultural land, soil health, and biodiversity exacerbate poverty, subsequently trigger migration dynamics, and cause deterioration in social structures.

To secure a sustainable future, it is essential to deepen scientific research, particularly along the following axes:

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**UNIVERSITY OF ÇUKUROVA,
FACULTY OF AGRICULTURE,
DEPARTMENT OF SOIL SCIENCE and PLANT NUTRITION**

1. Enhancing the adaptive capacity of agricultural systems; strengthening food security through the measurement of climate risks and the development of vulnerability maps at local and regional scales constitute core themes of the congress.
2. Ensuring the reliable monitoring of greenhouse gas emissions; assessing agricultural soils through resource-based monitoring approaches; increasing energy efficiency and accelerating the transition to clean energy; and promoting behavioral transformations encompassing transport–food–energy choices are imperative. Other emission sources related to agriculture and nutrition should likewise be addressed within a coherent contextual framework, and the findings should be discussed systematically at the congresses.
3. The expansion of open-data practices, the strengthening of interdisciplinary research networks, and the establishment of strategic information systems in key impact domains such as agriculture, water, energy, and health—together with improved inter-institutional coordination—will directly contribute to policy and practice.
4. As climate change is a policy issue with an international dimension, environmental sensitivity and scientific literacy on the part of countries and decision-makers are of vital importance. For the effective governance of anthropogenic global warming and climate change, leaders must be climate-literate.

In this regard, we believe that participants and speakers will further elevate the quality of the congress by presenting their work under timely themes, supported by current research data. We extend our thanks to the researchers contributing with oral and poster presentations and to the organizing committees whose efforts make this conference possible, and we express our conviction that the discussions will yield new partnerships, innovative projects, and scalable solutions in the field. We sincerely hope that the outputs and findings of CCIE-2025 will make concrete contributions—particularly to enhancing the resilience of our agricultural and food systems—and to regional development and global sustainability goals.

Best wishes

Prof. Dr. İbrahim ORTAS
Çukurova University,
World Congress Partner



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Ref./CCIE2025/M/2025/02

Date: 02.09.2025



Message from the Congress Chairman/ President AETDS

Dear Esteemed Delegates,

It is my profound honor and pleasure to extend a warm welcome to all of you at the *World Congress on "Climate Change and Its Effects (CCIE-2025)"*, being held from **6–8 September 2025** at **Central College, Kathmandu, Nepal**.

The *Agricultural & Environmental Technology Development Society (AETDS)* has always strived to promote scientific excellence, innovation, and interdisciplinary collaboration. By organizing this landmark event, we reaffirm our commitment to bringing together scientists, researchers, policymakers, extension professionals, students, NGOs, and industry stakeholders from across the globe to deliberate on the pressing challenges and solutions related to climate change.

With **nine major themes** and more than **seventy sub-themes**, this Congress covers a wide spectrum of issues—ranging from climate science, climate-smart agriculture, and biodiversity conservation to water and food security, socio-economic resilience, renewable energy, and the use of AI and digital tools in climate prediction. These discussions will not only deepen scientific understanding but also translate knowledge into actionable strategies and policies for building climate-resilient communities.

At AETDS, we believe that addressing climate change requires **collective global responsibility**. This Congress serves as both a platform for scholarly exchange and a catalyst for innovation and collaboration, inspiring pathways toward a more sustainable and equitable future.

I encourage all delegates to participate actively, share their expertise, and take back with them insights that will help transform communities, ecosystems, and institutions.

On behalf of AETDS, I wish CCIE-2025 grand success and look forward to the meaningful outcomes and collaborations it will inspire.

Warm regards,

Prof. (Dr.) C.P. Singh

President, AETDS

Former Professor, G.B. Pant University of Agriculture & Technology,

Pantnagar, Uttarakhand, India

Congress Chairman, *CCIE-2025*

Kumaun University, Nainital

Department of Geography

Dr. P.C. Chanyal

(Sr. Assistant Professor) &

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Message



I am deeply honoured to extend a warm invitation to you for the World Congress on "Climate Change and Its Effects (CCIE 2025)", scheduled to be held from 6–8 September 2025 at Central College, Kathmandu, Nepal, under the central theme "Climate Change".

This esteemed event is being jointly organized by a distinguished consortium of institutions, including the Department of Geography, D.S.B. Campus, Kumaun University, Nainital, in collaboration with several other prestigious partners from India and abroad. The Congress aspires to bring together eminent academicians, researchers, practitioners, and industry experts from across the globe to exchange ideas, share pioneering research outcomes, and deliberate on the multifaceted challenges and opportunities posed by climate change.

As the Organizing Convenor, it is my privilege to be part of this prestigious event. The program has been thoughtfully designed to include keynote lectures by globally renowned experts, thematic technical sessions, and interactive panel discussions, offering participants valuable insights into the latest innovations, trends, and future directions in science, agriculture, technology, engineering, and humanities.

I am confident that this conference will serve as a premier interdisciplinary platform enabling meaningful dialogue, inspiring fresh perspectives, and fostering enduring collaborations that will contribute to sustainable solutions for our planet.

I extend my heartfelt gratitude to all members of the organizing committee, our collaborators, sponsors, and distinguished speakers for their invaluable support in making this event a grand success.

We eagerly look forward to your active participation in CCIE 2025 and to welcoming you amidst the cultural richness of Kathmandu and the grandeur of the Himalayas.

Warm regards,

Dr. P.C. Chanyal

Organizing Convenor

World Congress on "Climate Change and Its Effects (CCIE 2025)"



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Ref./CCIE2025/M/2025/03

Date: 04.09.2025



Dear Delegates,

It's my immense pleasure and matter of pride that Agricultural & Environmental Technology Development Society (AETDS), U.K., India hosting World Congress on “*Climate Change and Its Effects* (CCIE 2025)” with the ideology of Impact of Climate of Change on current lifestyle. The graceful event is being hosted at Central College, Kathmandu, Nepal -The Land of Everest.

The lavish lifestyle of human involves excessive wealth and luxury, that imparts burden on the nature. This modern-day lifestyle ultimately ends up in changing the climate around us. Current scenario climate change and its impacts on agriculture and living world is an appropriate and relevant topic and is need of the hour to be emphasized. Convening all the research personnels of versatile departments is at desideratum. Research personals working on the current aspect are playing a pivotal role for developing climate smart technologies that can be employed in agriculture and other fields to mitigate the conflicts of climate change. Combating climate change and ensuring food security are prime importance at this hour. So, the intended three-day Congress aims to bring the participants of national and international repute around the world to disseminate and discuss their findings in the proposed sessions. I believe that, such kind of scientific gathering could play a vital role in making world a better place and also make ready to tackle any difficult satiation in the near future. I hope this congress will bring glory in bringing up the modern solutions to the modern problems.

I look forward in welcoming you all to the Land of Himalayan ranges *i.e.*, Kathmandu, Nepal

Dr. Kota Chakrapani
Organizing Co-Convener



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Ref./CCIE2025/M/2025/01

Date: 01.09.2025



Message from the Organizing Secretary & Secretary AETDS

Dear Delegates,

On behalf of the Organizing Committee, it is my great honor and privilege to welcome you to the *World Congress on “Climate Change and Its Effects (CCIE-2025)”*, scheduled to be held from **6–8 September 2025** at **Central College, Kathmandu, Nepal**.

This Congress serves as a dynamic international platform, bringing together scientists, academicians, researchers, extension professionals, students, policymakers, NGOs, industry stakeholders, and government representatives from across the globe. It provides a unique opportunity to exchange knowledge, experiences, and innovative solutions on the multifaceted challenges posed by climate change.

With **nine major themes** and more than **seventy sub-themes**, the scientific program will encompass a wide range of critical issues such as climate science, climate-smart agriculture, biodiversity conservation, water security, global warming, carbon emissions, socio-economic resilience, digital and AI tools in climate prediction, natural resource conservation, disaster risk reduction, and climate policy frameworks. The sessions will feature **lead lectures, contributory papers, and poster presentations**, complemented by **Best Presentation Awards** to recognize outstanding contributions.

The Congress is envisioned not only as a scholarly event but also as a **catalyst for collaboration and action**—fostering global partnerships, encouraging policy dialogue, and promoting sustainable strategies for building climate-resilient communities and ecosystems.

I sincerely hope that the three days of deliberations will be intellectually stimulating and will spark new ideas, collaborations, and pathways to address the pressing challenges of climate change. I am confident that the outcomes of CCIE-2025 will make a lasting contribution to both science and society.

I extend my warm wishes for the resounding success of this Congress and a rewarding experience for all participants.

With regards,

Dr. Wajid Hasan
Organizing Secretary

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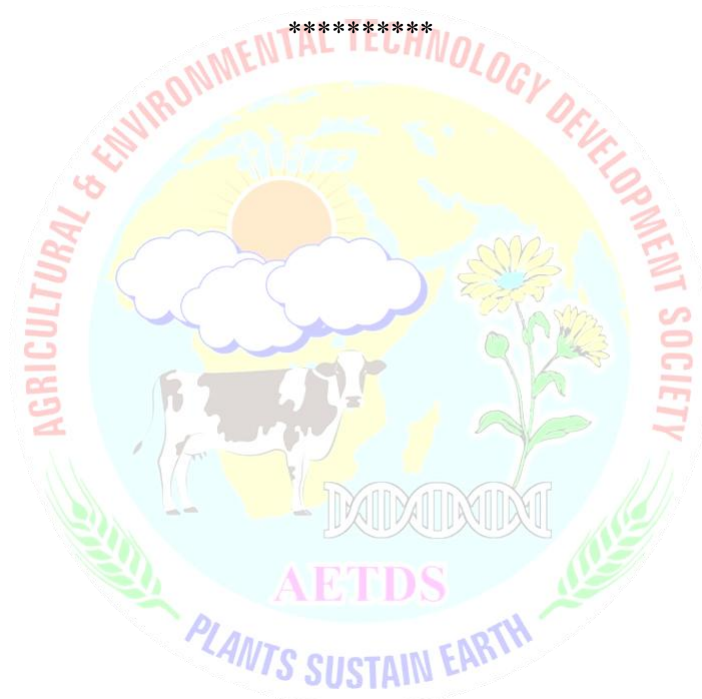
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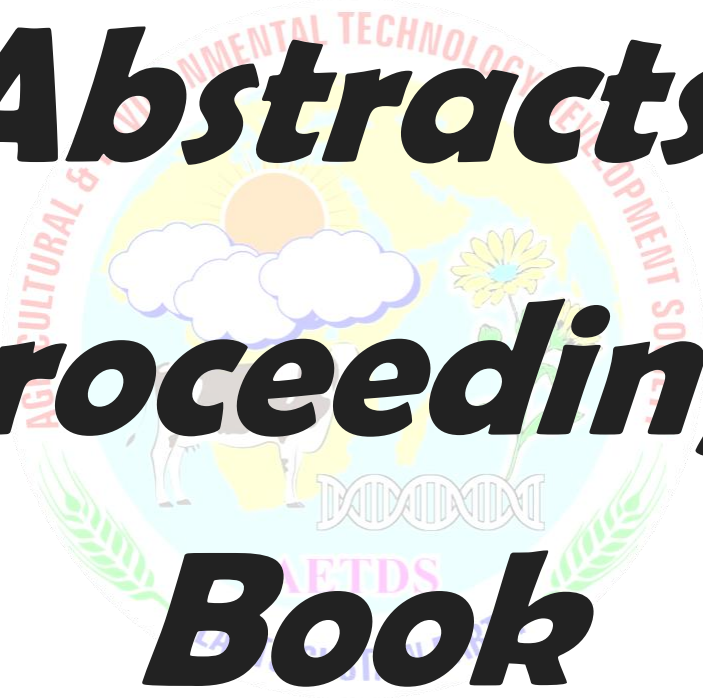
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Souvenir cum Abstracts/ Proceedings Book



Mangrove seedling growth, distribution, and diversity in Guyana's natural, degraded, and restored ecosystems**Sabrina Dookie¹, Sirpaul Jaikishun¹ and Abdullah Adil Ansari²**¹*Department of Biology, Faculty of Natural Sciences, University of Guyana. Georgetown, Guyana.*²*Faculty of Natural Sciences, University of Guyana. Georgetown, Guyana.***ABSTRACT**

Mangrove ecosystems offer a multitude of benefits to both humans and the natural environment, serving as a safeguard for other diverse terrestrial habitats globally, particularly in coastal regions. However, mangrove vegetation, particularly their seedlings, is exposed to several environmental stressors, which frequently reflect the current state and health of their ecosystems. We examined the density, diversity, distribution, survival rates, and biophysical parameters of over 900 naturally existing seedlings in natural, degraded, and restored ecosystems along the Guyana coastline. Systematic sampling was conducted for 1 year following the point-centred quarter method (PCQM) during the wet and dry seasons. Our findings show that mangrove seedlings can exhibit site-specific differences, which may be influenced by ecosystem type and seasonality to some extent. The restored ecosystems had greater seedling densities (1546.44–5506.303 individuals/ha), diversity (0.65–0.65), and richness (0.46–0.51) when compared to the natural and degraded ecosystems. Seedling survival rates [41.9–53.4%] were greater in the natural ecosystems, but short-term seasonal variations were prevalent in the restored ecosystems. Significant disparities were observed in seedling biophysical parameters [$df = 8$, $p < 2.2e-16$], which also exhibited positive correlations [$p < 0.05$, $r_s < 0.75$] within their respective locations. The restored ecosystems possessed taller seedlings (137.54 ± 4.68 cm) with a greater number of leaves (30.87 ± 1.51 – 107.30 ± 5.54), while the natural ecosystems possessed seedlings with greater stem diameters (3.05 ± 0.11 – 11.38 ± 0.37 mm). The persistent disturbances caused by human activities challenge seedling establishment during initial stages and may impact the ecosystem's ability to resist and recover from disturbances. The assessment of mangrove vegetation, particularly seedlings, across different ecosystem types over time can indicate their ecological health and ability to withstand and recover from particular environmental stresses. Our study underscores the critical need for potential conservation strategies and the sustainable use of mangrove resources to guarantee the ongoing provision of goods and services, alongside the preservation of this forest type.

Keywords: *biophysical parameters; ecosystems; Guyana coastline; mangroves; survival rates; seasonality; seedlings*

Seven-year phosphorus management and conservation agriculture increase yields and productivity in a lentil-black gram-maize system of the Eastern Indo-Gangetic Plains**Md. Ariful Islam^a, Md. Samim Hossain Molla^a, Md. Maniruzzaman^a, Md. Zahedul Hasan^a, Mehera Afroj Suborna^b Richard W. Bell^c**^a*On-Farm Research Division, Bangladesh Agricultural Research Institute, Pabna, Bangladesh.*^b*Department of Agriculture Extension, Rajbari, Goalondo, Bangladesh.*^c*Centre for Sustainable Farming Systems, Food Futures Institute, Murdoch University, 90 South Street, Murdoch WA 6150 Australia.***ABSTRACT**

The lentil-black gram-maize cropping rotation is an emerging maize-based system in the Eastern Indo-Gangetic Plains (EIGP). However, conventional crop establishment, poor residue management, and imbalanced phosphorus (P) fertilization often limit its productivity. To address this, we evaluated the long-term effects of conservation agriculture practices and P management on crop performance, yields, and overall system productivity. A long-term field study evaluated three tillage systems: conventional

tillage (CT), no-tillage (NT), and strip planting (SP); two residue levels: high (HR) and low (LR); and three P rates: 50 %, 100 %, and 150 % of the recommended dose. Results showed that SP improved yields of lentil, black gram, and maize by 11 %, 10 %, and 4 %, respectively, compared with CT, while NT increased black gram yield by 6 % but reduced lentil and maize yields by 2-5 %. Applying 150 % of the recommended P dose enhanced yield components and increased the yields of all component crops. Maize equivalent black gram yield (MEBY) and maize equivalent lentil yield (MELY) under SP and NT were 0.4-0.6 t/ha and 0.7-1.0 t/ha higher, respectively, than under CT. Higher yields were also observed under HR compared to LR, and under higher P rates compared to lower ones. Overall, maize equivalent system yield (MESY) was 8-9 % higher in SP than in CT or NT, 6 % higher in HR than LR, and 4-8 % higher at the highest P level. These findings suggest that adopting SP with HR and applying 150 % of the recommended P dose can substantially improve yields and system productivity of the lentil-black gram-maize rotation in the EIGP.

Keywords: *Bangladesh; Fertilizer optimization; maize equivalent yield; strip planting, no-tillage, high residue retention*

The Role of Zinc in Plant Growth and Human Nutrition Amid Climate Change

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ABSTRACT

Zinc (Zn) is a vital micronutrient essential for plant growth, human health, and ecological stability. Zn plays a critical role in gene expression, cell division, and photosynthesis by enhancing CO₂ assimilation and protein synthesis in plants. However, over 50% of agricultural soils globally are zinc-deficient, leading to reduced crop yields and lower nutritional quality—an issue known as "hidden hunger." Since Zn nutrition has a significant role in photosynthesis and CO₂ fixation, it affects the mitigation of atmospheric CO₂ concentration. This is particularly concerning in the context of global climate change, which exacerbates stress on crops and ecosystems through rising temperatures and environmental instability. Zinc deficiency affects not only plants but also over 2 billion people worldwide, contributing to severe health problems, especially among children. Zinc-enriched fertilizers have proven effective in improving water uptake, plant strength, and yield. Long-term experiments, such as those at Rothamsted in the UK, reveal a historical trend: while wheat yields have increased since 1845, zinc concentrations in seeds have declined significantly. This means food quality and human health will face serious problems. Several pot experiments were done by using different wheat genotypes to assess Zn deficiency. Two greenhouse experiments were carried out on Zn-deficient soil from the Central Anatolia Region by using 40 and 15 different bread and durum wheat genotypes in the first and second experiments, respectively. Plants were grown with (+Zn: 10 mg Zn kg/soil) and without (-Zn) Zn application in a randomly designed layout.

Generally, durum wheat genotypes produced less shoot and root dry weight compared to the bread varieties under both Zn treatments, but more evidently under Zn-deficient conditions. Moreover, the addition of zinc fertilizers significantly increases shoot and seed Zn concentrations.

Root-microbe interactions, particularly mycorrhizal colonisation, also influence Zn uptake. Zn-efficient genotypes exhibit better adaptation in Zn-deficient soils. The wheat genotypes vary in their zinc efficiency.

The results indicate that the higher susceptibility of durum wheat to Zn deficiency than bread wheat is related to both less root growth and poor mycorrhizal colonization of roots. To sustain food security and nutritional health under climate change pressures, addressing zinc deficiency in both soil and diet is paramount. This requires integrated agronomic, genetic, and policy-level solutions.

Agro-biodiversity in Himalayan Terai Region of Nepal and India: Past, Present and Future**Ram C. Chaudhary, A. K. Srivastava and P. K. Yadav***PRDF, Gorakhpur, Uttar Pradesh, India.***EXTENDED SUMMARY**

Himalaya as the youngest mountain range of the world was born some 65 million years ago. It was primarily formed by the process of plate tectonics, specifically the collision of the Indian (Nepal attached on its northern rim) plate and the Eurasian tectonic plates. About 65 million years ago, the Indian plate, which was previously part of a larger landmass called Gondwana, began to drift northward and collided with the Eurasian plate. This collision caused the Indian plate to subduct (slide) beneath the Eurasian plate, leading to the uplift and folding of the Earth's crust, resulting in the formation of the Himalayas. The continental drift after the split of Gondwana Land resulted into the movement of the Indian plate north-eastward. That resulted into the collisions between Indian (Nepal attached to it) and Eurasian (Chinese) plates that resulted into the disappearance of the Tethys Sea. Formation of Himalaya that is still ongoing as it increases its height 0.5 cm annually and movement eastwards by 25 cm annually. The tectonic movement of the plates below the earth crust gives tectonic tension that results into frequent earthquakes in Nepal, and India as well.

Resulting the Indo-Gangetic Plain, also known as the Northern Plain or North Indian River Plain, is a fertile plain spanning 700,000 km² (270,000 sq miles) across the northern and north-eastern part of the Indian subcontinent. It encompasses northern and eastern India, eastern Pakistan, southern Nepal, and almost all of Bangladesh. The region is home to many major cities and nearly one-seventh of the world's population. After the rise of the Himalaya, the Terai was formed by the deposits of the three major rivers – Sindhu (Indus), Ganges and Brahmaputra. The adjoining plain consists of the world's largest expanse of uninterrupted alluvium. Due to its rich water resources, it is one of the world's most densely populated and intensely farmed region.

Agrobiodiversity in the Indian Terai region refers to the rich variety of plant and animal lives that support agriculture and livelihoods in this fertile belt along the foothills of the Himalayas. This region, characterized by its subtropical climate and alluvial soil, is crucial for various crops and livestock, and its biodiversity is vital for food security and ecological balance. The Terai's fertile land supports a wide range of major crops, including rice, wheat, sugarcane, and various vegetables and fruits.

In the upper reaches of Nepal Terai, the steep elevational gradient contributes to high beta diversity, meaning a large number of species can be found within a relatively small area. Found are some Unique faunas like one-horn Rhino, unique breeds of sheep, goat, cow etc. The region is home to diverse breeds of cattle, buffalo, goats, and poultry, contributing to milk, meat, and other products. The wild life consists of tigers, elephants, deer, rhino, birds, reptiles, fishes etc. The Terai harbours wild relatives of cultivated crops like rice, sugarcanes, many vegetables fibre crops, which are important for breeding programs aimed at developing new varieties with desirable traits. Recognized and weedy species of medicinal plants are abundant in the Nepalese Terai. Currently these form the basis of Ayurvedic medicines. Local tribes know much more than recorded.

In Indian Terai, examples set for developing landraces in crops to double the farmers income are available in rice. Kalanamak rice is unique that is the native product of border area of Nepalese and Indian Terai. Now it is classed as the “Best Rice of the World” based on the nutrition it provides to human race. About 250 germplasm of Kalanamak rice were collected by Participatory Rural Development Foundation (PRDF) Gorakhpur from farmers and research institutions. These were described for 42 morph-agronomic characters, catalogued and conserved at National Gene Bank, New Delhi. Kalanamak was registered under Protection of Plant Varieties and Farmers Right Act (PPV & FRA). It received Geographical Indication (GI) tag for 11 districts in eastern U.P. Four improved varieties namely Kalanamak KN3, Bauna Kalanamak 101, Bauna Kalanamak 102 and Kalanamak Kiran

were released and notified by the government of India. Normal selling price of the Kalanamak paddy ranges between Rs. 4,000/- to Rs. 6,500/- per quintal contrary to Rs. 2,300 MSP announced by the governments. Summarily compared to Rs. 17,500 / ha net profit from common HYV rice, Kalanamak gives 3 times more profit. Under Paramparagat Krishi Vikas Yojna (PKVY) of the government of India, more than 25,000 farmers are growing it in U. P. districts along the Nepal border. Area under Kalanamak rice increased from 2,000 ha to 1,00,000 ha in 2025, all during last 20 years. It is grown in the Terai belt of Nepal also, Same Terai region of India and Nepal is thought as the region where rice originated. Origin of rice and origin of Himalaya have some close linkage. On the southern face of Himalaya, *Oryza sativa* f. sp. *indica* differentiated in various forms and cultivars, and on the northern face *Oryza sativa* f. sp. *japonica* differentiated.

Oryza species like *Oryza spontanea*, *Oryza perennis*, *Oryza, nivara*, *Oryza, rufipogan* etc. and forma *speciales* (f.sp.) like *Indica*, *Japonica*, Boro) differentiated in the southern and northern faces of Himalaya respectively and spread throughout the world. Participatory Rural Development Foundation (PRDF) collected 500 accessions of Boro rice from the same Himalayan Terai area of U. P. and reported immense genetic variability. Boro rice in studies was found to be a link between Indica and Japonica.

Positive size of the change in the agroclimate is evident from the formation of Terai region It is estimated that about 12.5% of total agrobiodiversity in India is present in this narrow strip of land called Terai. India is the richest centre of plant genetic diversity in the world. 10.9 % of global plant germplasm numbering to 45,400 families originated in Terai region of India. More than 70% of the rice (*Oryza* sp.) germplasm collected in the International Gene Bank of IRRI Philippines were resourced from India. The germplasm of *Oryza* has historic relationship with the origin of Himalaya that rose from the collision of Indian and Eurasian plates and disappearance of Tethys Sea, some 65 million years ago.

Future of this Terai region looks bleak due to various reasons including climate change, floods, drought, forest fires, deforestation, population pressure, urbanization and unsustainable use of the natural resources. Other factors could be Factors like climate change, habitat loss, and threaten the agrobiodiversity of the Terai. Monsoon pattern changes, droughts, and floods can affect crop yields and livestock health. So various management approaches have to be used to save this biodiversity rich region. Reduction of phyto-diversity must be halted to protect environment save the planet earth for future generations. Some ill effects like poisoning due to high level of elements like Arsenic in eastern Terai region including India, Nepal and Bangladesh are observed as the water table decrease and oxidation of lower strata of the soil go on. Phyto-remediation should be used to protect harmful chemicals like Arsenic entering in human food chain.

Collection of local and traditional knowledge Local communities possess valuable traditional knowledge about farming practices and the use of different plant and animal species, which is essential for managing agrobiodiversity.

Agrobiodiversity in the Terai provides various natural ecosystem services, including pollination, nutrient cycling, and soil health, which are crucial for sustainable agriculture. Conservation initiatives are crucial to safeguard the Terai's agrobiodiversity. These efforts include promoting sustainable farming practices, conserving wild relatives of crops, and empowering local communities to manage their resources. Vertical farming and forms of gardening should be promoted to decorate house, produce family food and help in conserving land and environment. Beginning of agriculture and rise of the civilizations occurred within the last 12,000 years. Thus, changing climate has created ample genetic variability, a process that will go on until earth disappears. Ecotourism should be developed and promoted for health, wealth and sustainable use of natural resources. There is lot of room for educating people to do their bit in keeping their surroundings clean and green and use the natural resources sustainably. May be the youngest foothills and depressions of Teri of Nepal and India could set an example of conserving and utilising agrobiodiversity sustainably.

Keywords: *origin of Himalaya; Terai; Tarai; agrobiodiversity; Boro; Kalanamak; environment*

Exploring Seaweed-Derived Biostimulants to Counter Arsenic-induced Oxidative Stress in Wheat: Roles of *Gracilaria tenuistipitata* and *Ascophyllum nodosum*

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ABSTRACT

Arsenic (As) toxicity is a rising concern due to its deleterious impact on the plant's growth and developmental process. Therefore, the current study aimed to evaluate the effect of As toxicity on wheat plants (*Triticum aestivum* cv. BARI Gom-33), as the soil was contaminated with 100 mg kg⁻¹ sodium arsenate (Na₃AsO₄·7H₂O), with or without supplementation of *Gracilaria tenuistipitata* compost (GTC) or *Ascophyllum nodosum* extract (ANE). Plants treated with As showed reduced relative water content (RWC) and K⁺ ion content, and increased proline accumulation, indicating an imbalance in osmotic adjustments. Oxidative stress indicators, malondialdehyde content (MDA), hydrogen peroxide content (H₂O₂), and electrolyte leakage (EL) increased in wheat plants under As stress. Moreover, the As-affected plants showed higher levels of dehydroascorbate (DHA) and oxidized glutathione (GSSG), and lower levels of ascorbate (AsA) and glutathione (GSH); thus, the ratio of AsA/DHA and GSH/GSSG decreased in plants. In contrast, the plants that were additionally supplemented with GTC or ANE showed a reduction in the contents of MDA and H₂O₂, EL, and also showed improvement in AsA/DHA and GSH/GSSG ratios in plants under similar As stress levels. The GTC and ANE-supplemented plants improved RWC and K⁺ ion content and lessened proline accumulation under As stress. Moreover, the activity of antioxidant enzymes, such as catalase, ascorbate peroxidase, monodehydroascorbate reductase, dehydroascorbate reductase, glutathione reductase, peroxidase, glutathione peroxidase, glyoxalase I, and glyoxalase II, was enhanced with the GTC and ANE application under As stress. Thereby, the growth attributes that were adversely affected under As stress showed improvement with the GTC and ANE applications. Thus, the findings of the current study indicate a potential role of GTC and ANE application in protecting the plants from As-induced damage. Both GTC and ANE enhanced As tolerance, but it was observed that foliar spraying of 0.02% ANE performed better by reducing oxidative damage and improving antioxidant enzyme activities over plants treated with ANE. These improvements play a crucial role in strengthening wheat's resistance to drought conditions.

Keywords: Abiotic stress; heavy metals; seaweeds; brown algae; antioxidant defense system; glyoxalase system

The Importance of Symbiotic relationship between Mycorrhiza (Natural and Selected) and Citrus Rootstocks in combating salinity stress.

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ABSTRACT

Salinity and other abiotic stressors, such as inadequate soil drainage, drought, and water evaporative stress, interact both directly and indirectly in citrus. Salt damage and harmful ion buildup can be reduced by enhancing tree water relations through optimal irrigation/drainage management, preserving nutritional balances, inoculation of mycorrhizae, and reducing evaporative demand. In addition to directly affecting root infections, salinity can make citrus rootstocks more vulnerable to diseases and

root rot attacks. This research focuses on evaluating the impact of indigenous and selected arbuscular mycorrhizal fungi (AMF) inoculation on the growth and nutrient uptake of citrus rootstocks, while also exploring the potential role of mycorrhizae in enhancing soil carbon sequestration through improved photosynthesis related to climate change.

Keywords: Salinity, citrus, Mycorrhiza, climate change

Material and Methods

The experiment was carried out under the greenhouse of the Faculty of Agriculture, Soil Science and Plant Nutrition Department in Çukurova University, located in the eastern part of Adana, in the Mediterranean region of Turkey. The selected coastal soil was collected from the coast of the Mediterranean region, part of Turkey. Selected soil was divided into 2 parts as sterile and non-sterile. Two different citrus rootstocks were used in the research. The species used are Cleopatra mandarin (Citrus reshni) and C35 citrange. Three different types of mycorrhizal applications were used as mycorrhiza (control, defined indigenous mycorrhiza, and *Rhizophagus clarus*). One healthy, uniform citrus seedling was placed in each pot, which had 2 kg of soil, and the seedling received approximately 1000 mycorrhizal spores. The trial was carried out according to the randomised plot design with 3 replications. At harvest, plant growth parameters and mineral nutrients were determined.

Results

The results showed that mycorrhizal treatments helped the plants manage the salinity stress. C35 citrus species is more resistant than the Cleopatra sp. in the presence of mycorrhizae under saline conditions. Also, mycorrhizal treatments were more effective in sterilised soil conditions rather than non-sterilised soil under salinity stress.

Conclusions

It has been observed that mycorrhizae inoculation into the saline soil assisted the plants and seedlings in overcoming the salt stress. In the +mycorrhizal treatments, plants exposed to saline soils that had been sterilised grew more. However, because the biome in non-sterilised soils was not disturbed, there were no appreciable variations between the treatments. To sum up, certain mycorrhiza can be a useful tool for overcoming environmental stressors like salinity and improving crop yields.

Note: This work was supported by PRIMA SHARING-MED-2211.

Coastal Pollution due to Natural and Anthropogenic Activities, Impacts, and Protection Methods: A Review

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ABSTRACT

Coastal zones, representing the interface between land and sea, are highly dynamic and ecologically significant environments. They are also increasingly vulnerable to pollution stemming from both natural processes and, more significantly, anthropogenic activities. This review paper describes the complex interplay of these pollution sources, their detrimental impacts on coastal ecosystems and human populations, and the various protection methods that can be implemented to mitigate these threats. Natural sources of coastal pollution include geological weathering, volcanic eruptions, and atmospheric

deposition, contributing primarily to nutrient loading, heavy metal contamination, and sediment runoff. However, anthropogenic activities, such as industrial discharge, agricultural runoff, sewage disposal, plastic pollution, and maritime transport, are recognized as the dominant drivers of coastal degradation. These activities introduce a broad spectrum of pollutants, including nutrients, persistent organic pollutants (POPs), heavy metals, microplastics, and pathogens, exceeding the natural assimilative capacity of coastal ecosystems. The impacts of coastal pollution are far-reaching. Eutrophication, fueled by excessive nutrient input, leads to harmful algal blooms (HABs), oxygen depletion, and habitat loss. Contaminants, particularly heavy metals and POPs, bioaccumulate in marine organisms, posing risks to human health through seafood consumption. Plastic pollution, including microplastics, contaminates the food web, endangers marine wildlife through entanglement and ingestion, and disrupts ecosystem functions. The degradation of coastal habitats, such as mangroves and coral reefs, reduces coastal protection against storms and erosion, exacerbating the vulnerability of coastal communities to climate change impacts. Effective protection of coastal environments requires a multi-faceted approach. Integrated Coastal Zone Management (ICZM) strategies, encompassing legal frameworks, environmental regulations, and participatory governance, are crucial for minimizing pollution at its source. Wastewater treatment technologies, including advanced oxidation processes and constructed wetlands, can significantly reduce the discharge of pollutants from municipal and industrial sources. Sustainable agricultural practices, such as reduced fertilizer use and the implementation of buffer zones, can mitigate nutrient runoff. Promoting the circular economy through waste reduction, reuse, and recycling programs is essential for tackling plastic pollution. Furthermore, restoring and enhancing coastal habitats, such as mangroves and salt marshes, can improve water quality and provide natural defenses against coastal hazards.

Keywords: *Coastal pollution; Anthropogenic activities; Pollutants; Sources; Reduction*

An Advanced Review on the Impacts of Global Warming on the Agricultural Aspects and the Importance of the Mitigation

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ABSTRACT

Global warming has been identified as a huge environmental issue that associated with various components of the earth and particular activities linked with them. The presence of excess amounts of CO₂, CH₄, NO_x, SF₆, some hydro-chlorofluorocarbons, hydro-fluorocarbons, O₃, NF₃ and water vapor (greenhouse gases) is the significant sources for the global warming since the impact is being increased due to the industrial and automobile emissions. Global warming is defined as increasing of global temperature with the presence of some gasses (greenhouse gases) which are able to trap solar radiations, store them and release them to the surrounding environment while reducing the heat transfer towards the upper atmosphere back. The incident causes the increasing of temperature of the environment. According to the considerations of the impact of global warming on the various sections of the earth, agricultural activities are affected in different stages and different similitude by the global warming. In the consideration of those environmental impacts, basically they can be categorized as the positive impacts and negative impacts based upon the relevant changes in the particular agricultural systems. According to the short listing of both positive and negative impacts on the agricultural systems, the increasing of productivity/ harvest of crops because of the increasing of CO₂ gas in the atmosphere/ environment, generations of new crop varieties with respect to the temperature rising, variation in the

growth period, expansion of the area that suitable for cultivation such as the polar areas due to the reductions/melting of snowcap and the reduction of the adverse impact on the winter crops can be emphasized. In the elaboration of negative impacts on the agricultural systems, the adverse impacts on the quality of products/ harvest, increasing of the soil erosion and decreasing of soil fertility, increasing of the disasters including weeds, insects and pests, impacts of floods and droughts on agricultural lands are predominantly found adverse impacts. When considering of the mitigation methods of the greenhouse effect, the limitations/ reductions of fossil fuel burning, increasing and developments of the applications of renewable energy sources such as the wind, solar and hydro power to enhance the sustainability.

Keywords: *Global warming; Greenhouse gases; Positive impacts; Negative impacts; Mitigations*

The Effects of Long-Term Organic and Inorganic Fertilization on Soybean Yield, Carbon and Nitrogen Content

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Purpose

The soybean plant is infected with Rhizobium bacteria and mycorrhizal fungi, which are efficient soil organisms. Since then, soybeans have fixed high amounts of nitrogen and carbon from the atmosphere. Carbon and nitrogen gases significantly affect climate change. This work aims to test the effects of mineral and several organic fertilizers on N and carbon contents and CO₂ capturing under long-term field conditions.

Material and Methods

The experiment was established in 1996 within the Soil Science and Plant Nutrition Research Area of the Research and Application Farm of the Faculty of Agriculture at Çukurova University, which is located in the cost of the Mediterranean. The current research began with Soybean (*Glycine max* (L.) Merr.) cultivation during the 2022-2023 production year. Before cultivation, control, mineral fertiliser (NPK), animal manure (25 tons ha⁻¹), compost (25 tons ha⁻¹), and compost + mycorrhiza (10 tons ha⁻¹) were applied. After harvest, the soybean's shoot, root and yield data were recorded. The nutrient content of different parts of the plant was analysed. Total carbon and nitrogen contents were calculated. All data were statistically analysed.

Results

In general, compost, compost+mycorrhiza, and subsequently manure applications produced higher yields and biomass than the control plot. Also, organic fertiliser, compost, animal manure and compost+mycorrhizae have high K%, P% and Zn (mg Zn kg) concentration. The highest total nitrogen and carbon contents were found in compost and compost + mycorrhizae treated plots. Compared to control treatment, compost-treated plots have 4041 kg ha⁻¹ more CO₂ capture. Compost-treated plots have 158 kg ha⁻¹ more nitrogen than control plants.

Conclusions

Overall results show that organic fertilizers produce high biomass and accordingly, capture high N and C. Capturing more N and CO₂ is very important for the mitigation of atmospheric greenhouse gases. Also, with organic fertilizer treatments capturing more nitrogen is promising for the future to reduce mineral fertilizer use, which is important for ecosystem health and climate change as well.

Keywords: *Soybean; Carbon; Nutrient; Compost; Manure*

Note: This work was supported by PRIMA SHARInG-MeD -2211

Research also, supported by Cukurova University Scintific Research Unit, Project no: FYL-2023-15931

Cotesia flavipes dynamics in *Chilo sacchariphagus indicus* of sugarcane: evidence for parasitoid resilience to local climate change and habitat shrinkage**J. Srikanth¹, P. Mahesh¹, K.P. Salin¹, M. Punithavalli¹, V.S. Pranamy², J. Saketh³, K. Subadra Bai¹ and R. Nirmala¹**¹*Section of Entomology, ICAR-Sugarcane Breeding Institute, Coimbatore, India.*²*Indiana University Bloomington, USA.*³*North Carolina State University, USA.***ABSTRACT**

Seasonal dynamics of *Cotesia flavipes* Cameron (Hymenoptera: Braconidae), a gregarious larval endoparasitoid of sugarcane internode borer *Chilo sacchariphagus indicus* (Kapur) (Lepidoptera: Crambidae), were monitored in growers' farms at Coimbatore, Tamil Nadu State, India, during 2013-16. Borer larvae were collected every month from 5-6 month-old crop and maintained in the laboratory on tender shoot bits of sugarcane. Monthly parasitism rates assessed from the number of cocoon masses emerged and number of larvae collected were the lowest in 2013 and highest in 2015. Correlation analysis indicated that weather parameters of the current or previous month did not influence parasitism rates consistently. Since parasitism rates in the current study period (2013-16) (Block-II) were generally higher than those observed by us about two decades earlier (1991-93) (Block-I) in the same crop habitat, we examined changes in weather parameters and cropping pattern to determine their impact on the observed changes in parasitism rates. Student's and Welch's t-tests, and Mann-Whitney U test comparisons of monthly weather parameters indicated significant increase in mean maximum and minimum temperature and decrease in Forenoon RH from Block-I to Block-II whereas afternoon RH and rainfall did not differ between the two blocks; monthly parasitism rates of *C. flavipes* increased from Block-I to Block-II. Two-way factorial ANOVA of weather parameters and parasitism rates considered month-wise and averaged for four seasons (Indian Meteorological Department) confirmed these trends. Mann-Kendall and Sen's slope analysis indicated clearcut increase in maximum and minimum temperatures between the two block periods. Further, area of cultivation under sugarcane and sorghum, two crops that harbor borer hosts of the parasitoid, declined over the two-decade study period. Apparently similar levels of *C. sacchariphagus indicus* and increasing trend in *C. flavipes* activity between the two blocks suggested the resilience of the parasitoid to local climate change and its ability to exploit the overall diminishing food resources.

Keywords: *Sugarcane; internode borer; Chilo sacchariphagus indicus; Cotesia flavipes; parasitism rates; seasonal dynamics; climate change; habitat shrinkage; parasitoid resilience*

State Universities: Catalysts of Entrepreneurship and Innovation**Sumita Kachhwaha**

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EXTENDED SUMMARY

For decades, state universities have stood as pillars of education and research in India. Today, their role is rapidly evolving. No longer confined to classrooms and traditional academics, they are emerging as dynamic ecosystems where ideas, inclusion, and innovation intersect to shape a better future. By fostering entrepreneurial mindsets and promoting socially responsive innovation, these institutions are transforming themselves into key players in creating a sustainable and equitable society.

In an age marked by climate urgency, widening inequality, and rapid digital transformation, entrepreneurship has transcended its economic role—it is now a catalyst for meaningful societal change.

The ventures of the future must not only seek profits but pursue purpose. This is where sustainable, inclusive, and technology-driven entrepreneurship comes into play.

The **National Education Policy (NEP) 2020** places innovation, skill development, and entrepreneurship at the core of higher education. As primary providers of education to millions of students, state universities are uniquely positioned to translate these objectives into action. With their extensive reach and accessibility, they can become the backbone of India's entrepreneurial landscape. By adopting NEP's vision of holistic and multidisciplinary learning, and by fostering innovation-driven ecosystems, they can help create not just job seekers, but job creators—accelerating India's transition to a knowledge-based and self-reliant economy.

Building Ecosystems of Innovation

State universities are now actively setting up **Entrepreneurship Development Cells (EDCs)**, **Technology Business Incubators (TBIs)**, and **Innovation & Startup Hubs**. These platforms offer infrastructure, mentorship, seed funding, and networking opportunities. By forming strong linkages with industries, local businesses, and communities, universities are ensuring that students' ideas move beyond theory to real-world impact.

Curriculum reforms under NEP 2020 allow entrepreneurship courses, design thinking, and innovation modules to be woven into every discipline. Vocational education, experiential learning, and internships are fostering real-world problem-solving abilities. Students are encouraged to ideate, develop, and commercialize innovations with institutional support.

The existing infrastructure and intellectual capital of state universities can deliver much more—organizing events to stimulate creativity, translating research outputs into marketable products, and facilitating access to funding through grants and government schemes like **Startup India** and the **Atal Innovation Mission**. Universities can leverage alumni, entrepreneurs, and professionals to mentor budding innovators, while supportive policies on IPR, startup leave, and equity participation can further encourage innovation.

Innovation Ecosystem (Start-ups: Exhibitions)

ATM (Academics to Marketability) Scheme for Promoting Startups & Innovation

Incubation Duration	Eligible Candidates
1 to 3 months or Depending on the requirements of incubation	Student Faculty of Colleges & Universities

SPICE (Scheme for Promoting Innovator's to Choose Entrepreneurship)

Incubation Duration	Eligible Candidates
1 (one) month to 6 (Six) months depending on the requirement of incubatee.	Innovator with novel technology/products from various disciplines.

UnITE (University Innovator to Entrepreneur)

Incubation Duration	Eligible Candidates
1 (one) month to 3 (Three) months depending on the requirement of incubatee.	Students of Colleges & Universities

A Success Story: University of Rajasthan

Among these rising institutions, the **University of Rajasthan** stands out as a pioneer. One of India's oldest and largest state universities, it houses the **Entrepreneurship and Career Hub (ECH)**—an incubation centre established with support from **MHRD-RUSA 2.0**. This centre has already incubated over 40 startups, several of which are leveraging its state-of-the-art facilities.

The ECH provides incubation space, research access, IPR filing support, mentorship, and financial assistance through various schemes. Its impact is visible—not just in the minds of students and faculty but also across the city, where people now see universities as hubs of innovation. From supporting alumni-led startups like **Kapcha Robotics**, **Nanomatrix**, **MiniMines Pvt.Ltd.**, **Stubborn**, and **Vigore-bike**, to promoting IPR awareness, skill development workshops, and outreach programs, the centre has earned recognition as a model of entrepreneurial success in Rajasthan, India.

The Road Ahead

If every state university were to establish structured incubation platforms—offering physical space, seed grants, mentorship, and IP support—the ripple effect would be transformative. By integrating entrepreneurship into curricula, promoting cross-disciplinary teams, and engaging with local sectors such as agriculture, rural healthcare, and climate technology, universities can solve pressing societal challenges while nurturing innovation.

Special programs targeting underserved groups—women, rural entrepreneurs, and economically weaker sections—can align these efforts with NEP's inclusion goals. Shared infrastructure, open labs, and faculty expertise can further empower these initiatives.

A Collective Call to Action

Creating a society that thrives on sustainable innovation requires collaboration. Policymakers must provide enabling frameworks—green subsidies, inclusive incubators, and digital infrastructure. Educators must empower future leaders with entrepreneurial thinking rooted in responsibility and empathy. Investors must prioritize impact-driven ventures, measuring success beyond financial returns.

Conclusion

This is India's moment to harness its intellectual capital and unleash its creative potential. State universities are no longer passive participants in education—they are **frontiers of transformation**, building ecosystems that empower students to become visionaries, problem-solvers, and entrepreneurs. Through purpose-driven campuses, India can craft a resilient, inclusive, and self-reliant economy powered by innovation and inspired by intention.

Long-term impact of Land Use Change on Soil Organic Carbon and Nitrogen Sequestration in cropland soils

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EXTENDED SUMMARY

Purpose

Elevated levels of atmospheric carbon dioxide (CO₂), mainly driven by the burning of fossil fuels, the combustion of organic matter, and unsustainable management practices, have intensified concerns regarding climate change globally. Various soil and crop management factors, including land use mainly intensive soil cultivation, management history, soil type, and climate change, influence the dynamics of soil organic carbon (SOC) and total nitrogen (TN) in cropland soils. The goal of the present research was to quantify the storage and sequestration of SOC and total nitrogen (TN) under different land uses in cropland soils of Adana, Turkey.

Materials and Methods

A long-term experiment encompassing different land uses: i) A-1 long-term fallow, ii) A-2 Cultivated and fallow, iii) A-3 continuously Cultivated, iv) A-4 Once in a year cultivated, v) B-1 Fallow border of field, vi) C-1 Wheat-Maize rotation. In 2000, a section of cropland that had been cultivated for many years was left fallow, while other parts continued with regular agricultural activities. After 17 years, SOC and TN were reanalyzed at 0-40 cm.

Results

The results showed that at 0-10 cm depth, B-1 land use (fallow border of the field), followed by A-1 (long-term fallow), showed the highest increments (25% and 22%, respectively) in SOC content compared with A-1, which was cultivated land use in the year 2000. At subsurface layers, for all land uses, the fallow indicated the highest SOC contents, ranging from 23% to 110%. Whereas, continuously cultivated land use showed the minimal SOC content, especially at 0-10 and 10-20 cm layers. Overall, our findings suggested that the fallow land use retained more SOC and TN. The A-2 land use (i.e., cultivated and fallow) also showed promising results. There were variable increments observed in the case of TN at 0-40 cm soil layers, whereby there is an overall increase (range = 2.26-26.4%) observed under A-3. The measured data indicate that, compared to continuously cultivated and cultivated areas, more carbon was sequestered in the bare and levee to natural life soils, and annual carbon sequestration was higher in areas left to natural habitats. Organic carbon loss was observed in the first 0-20 cm of continuously cultivated areas and wheat-corn rotations.

Conclusions

The findings imply that if we properly and ecologically manage the soil, such as A-2 practice prudently, we can further enhance the SOC storage in the soil. In the face of current climate change, it is important to retain more SOC in the soil to ensure future soil health and food security.

Keywords: Land use; soil health; cultivation; nitrogen; C sequestration

Funding: This work was supported by PRIMA SHARInG-MeD -2211

The Effect of Different Organic and Inorganic Fertilizer Applications on Yield and Soil Carbon Budget of Soybean Crop Under Long-Term Field Conditions

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ABSTRACT

Ineffective soil and plant management practices have profound negative impacts on soil biological quality, fertility, and climate change. To mitigate these negative impacts, it is necessary to increase soil organic carbon (SOC) content. Common organic fertilizers such as compost, animal manure, and inoculated mycorrhizal fungi contribute significantly to soil organic carbon storage, and this contribution leads to positive effects on soil biodiversity and soil health. The project hypothesis is that organic fertilizer applications increase SOC in long-term field conditions. The study aims to investigate the effects of different organic and inorganic fertilizer applications on SOC content.

To confirm this hypothesis, a long-term field trial was conducted in 1996 at the Cukurova University field site (37° 0'55.53"N 35° 21'20.56"E). In 2023, inorganic fertilizer (NPK), animal manure (25 t ha⁻¹), compost (25 t ha⁻¹), and mycorrhizal compost (10 t ha⁻¹) were applied to the plot before planting. After harvest, soil samples were taken for total and organic carbon analysis.

The results showed that carbon concentrations in soybean-planted plots were measured at depths of 0-15 cm and 15-30 cm % 1.18 ve % 1.11 as in control plots, respectively, while carbon concentrations at the same depths in animal manure-applied plots were 1.71% and 1.48%, respectively. Overall, more SOC was retained in soybean plots treated with compost and compost+mycorrhiza. Statistical analysis, which also took into account differences between experimental subjects, revealed significant differences

in total C and SOC concentrations. Compared to the control, at 0-15 cm soil depth, the contribution of mineral fertilizer was 23%, animal manure 38%, compost 36%, and compost + mycorrhiza 43%. Similar patterns were observed with lower percentages at 15-30 cm soil depth. The Animal Manure application counted 44 spores/10g of soil at depths of 0–15 cm and 40 spores/10g of soil at depths of 15–30 cm, respectively, while the Mycorrhiza+Compost application counted 77 spores/10g of soil and 33 spores/10g of soil, respectively. Spore counts were significantly higher than those obtained with the control and mineral fertilizers.

According to the results, there is a positive correlation between spore counts and organic carbon values. This indicates that organic practices increase microbial activity. Increased microbial activity, as is well known, improves soil health, which indirectly reduces the negative effects of climate change. Evaluation of organic fertilizers such as compost, compost + mycorrhiza, and animal manure shows important benefits for sustainable agriculture and climate change mitigation.

Keywords: Soybean; Nitrogen; Organic Carbon; Organic and inorganic fertilizers

Note: This work was supported by PRIMA SHARInG-MeD -2211. Research also supported by Cukurova University Scientific Research Unit, Project no: FYL-2023-15931.

Effect of Salicylic Acid on Shorea robusta seedlings under Water and Temperature stress

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EXTENDED SUMMARY

Shorea robusta (Sal) is highly valued for its ecological, spiritual, therapeutic, and economic importance, and has long been utilized primarily for timber production. Increased incidences of fires and drought under the changing climatic conditions have threatened the sustainability of forests across the world and increased tree die-offs. Sal forest's ability to regenerate is threatened under the current scenarios. Dying back of Sal seedlings needs to be prevented for conservation of forests. Preservation and management of Sal forests are important under prevailing adverse conditions. Developing strategies to make seedlings more resilient to changing climatic conditions is necessary. Priming is one such strategy that enhances stress tolerance in plants and improves growth under stressful conditions. Salicylic Acid (SA) is the phenolic plant growth regulator that modulates plant growth and development and is involved chiefly in plant defense (Kulak et al., 2021). In our study, Sal seeds were collected and were primed in different concentration of SA. Seedlings were further subjected to varied conditions of water and temperature. Primed seeds had better seedlings survival as compared to the untreated ones. Primed seedlings also exhibited higher photosynthetic and antioxidant enzymatic activity. SA can be viewed as a promising priming agent and can be applied to other important plant species for their survival under climatic stress conditions.

Objectives

To study the effect of priming on germination and physio-biochemical parameters under water and temperature stress.

Methodology

Experimental Set-up

Seeds of the species were collected from the local Sal forests in and around Dehradun. Salicylic Acid was selected as the priming agent. The solution of selected priming agent of different concentration was prepared for seed priming. Afterward, the seeds were germinated in seed germinators (Temp: 25±2°C). Seed germination percentage was estimated as per the formula described by ISTA (2010). Germinated primed seeds were transferred to polybags for further experiment. The primed seedlings were treated

with various regimes of selected abiotic stress factors especially water and temperature. The seedlings were exposed to water regimes (50%, 75%, and 100% of field capacity and temperature (Ambient, Ambient -4 °C, Ambient +4 °C). Prior to the water treatment, water holding capacity of the pot was computed as per the standard procedure.

Parameters Estimation

Morphological parameters such as seedling height and diameter, number of leaves, leaf area etc. were recorded. Physiological responses in terms of carbon assimilation, stomatal conductance, transpiration rate, water use efficiency etc. were noted using portable photosynthesis system. The Biochemical parameters like chlorophyll content, leaf proline accumulation and antioxidant enzymatic activities were done after the experiment completion.

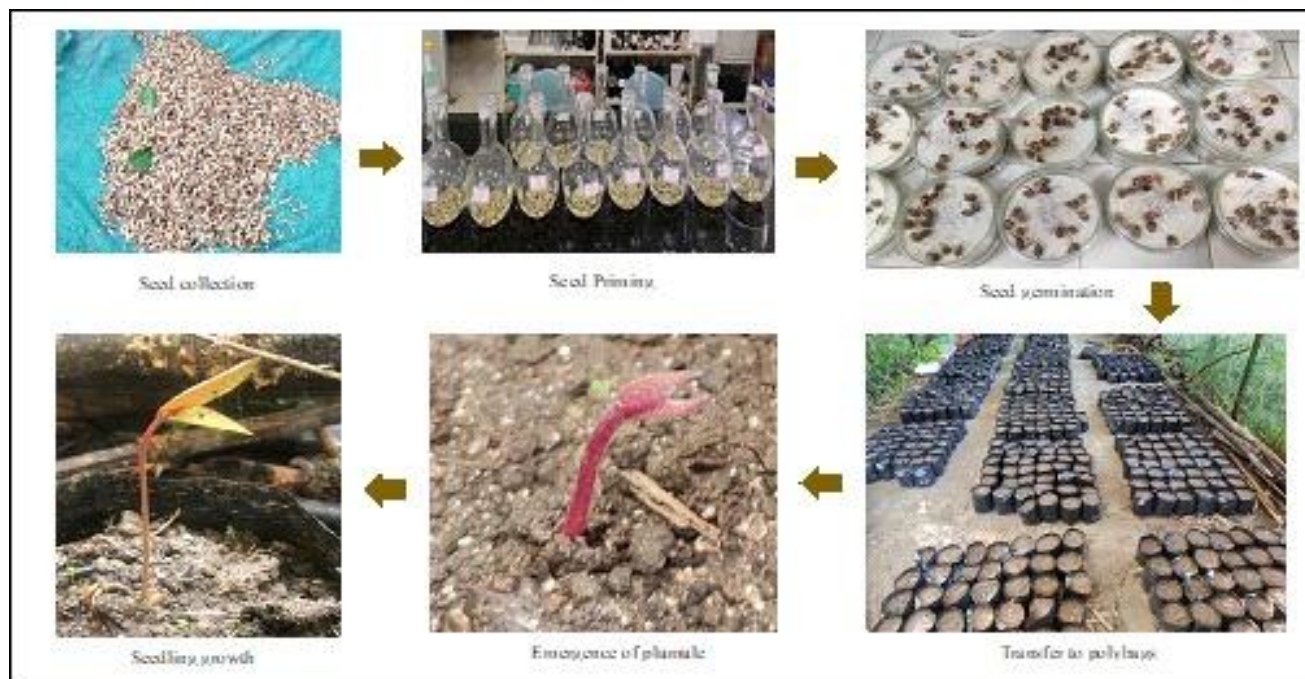


Figure 1: Seeds were collected from Dehradun Sal forests for priming and were germinated in seed germinator. Later they were transferred to polybags for further experiment.

Results

Better seedling growth was observed at Ambient -4 °C temperature condition and with 100% field capacity and maximum seedlings survived with 5mM SA concentration.

Conclusion

Preliminary results of our study indicates that maximum seedlings survived under 5 mM priming condition. This can be further applied in field to check the success of the study. Our study concluded that priming can effectively ameliorate stress conditions in Sal and help in seedling survival. Priming strategy can also be applied for other ecologically important tree species for conservation practices under adverse climatic conditions.

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Keywords: *Sal; abiotic stress; priming; climate change; conservation*

Dry Soils and Strong Roots: Analyzing the Mechanism of Drought Resilience in Sunflower (*Helianthus annuus* L.)**Laraib Chouhdary¹, Gulzar Akhtar¹, Muhammad Hammad⁴, Noreen Amjad¹, Ali Zia², Waqar-Ul-Hassan², and Sana E Mustafa³**¹*Department of Botany, Faculty of Sciences, University of Agriculture, Faisalabad, Pakistan.*²*Department of Plant Breeding and Genetics, Faculty of Agriculture, University of Agriculture, Faisalabad, Pakistan.*³*Rice Research Institute Kala Shah Kaku, Pakistan.*⁴*Department of Biological Sciences, Thal University Bhakkar, Bhakkar, Punjab, Pakistan.***ABSTRACT**

Sunflower (*Helianthus annuus* L.), a vital oilseed crop also used for ornamental purposes, expresses moderate drought tolerance, vital for sustaining yields amid climate change-induced water scarcity. This review elucidates the physiological, biochemical, and molecular adaptations of sunflowers to drought stress. Physiologically, sunflowers develop deep taproot systems, extracting up to 40% of subsoil moisture, and reducing leaf area to minimize transpiration. Biochemical adaptations include osmotic adjustment through the accumulation of proline and betaine and maintaining turgor under drought conditions. Antioxidant systems, such as superoxide dismutase and ascorbate peroxidase, increase 1.5–2-fold to mitigate damage caused by reactive oxygen species (ROS). Molecularly, transcriptomic studies identify 2,589 differentially expressed genes (DEGs) in leaves, with transcription factors (bHLH025, NAC53, AP2/ERF) having a role in the regulation of stress responses. Dehydrin genes (HaDhn1, HaDhn2) enhance turgor maintenance in tolerant lines. Genomic analyses reveal QTLs on chromosomes 3 and 13 for water-use efficiency (WUE), with hybrids like CMS-234A × P124R showing 10–15% higher water use efficiency. However, severe drought conditions reduce achene yield by 30–50% and oil content by 5–10% due to impaired activity of the RuBisCO enzyme. Agronomic practices (e.g., drip irrigation, early sowing) and CRISPR/Cas9 editing of Hahb4 enhance resilience against drought conditions. Integrating breeding, microbial inoculation, and optimized management can sustain sunflower productivity in arid regions, which help in addressing climate change challenges.

Keywords: *Sunflower; drought tolerance; climate change adaptation; oilseed crop***References**

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New record of Sandalwood Defoliator *Amata passalis* Fabricius (1781) (Lepidoptera: Erebidæ: Arctiinae) from Bihar (India), with systematic account, distribution, host plants, and control measures.

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ABSTRACT

The present communication deals with the new record of *Amata passalis*, the Sandalwood Defoliator, from Jehanabad, Bihar (India), which is also the first find for Bihar state as well. It belongs to the subfamily Arctiinae under the family Erebidæ and order Lepidoptera. It is a day-flying moth with characteristic black wings having whitish spots and an orange-banded black abdomen. It is mainly a pest of sandalwood, causing great damage to the plant by defoliating, as the name given, but also known to infest other plants, like cowpeas, pulses, and ornamental plants. Its bright-coloured body helps in self-defense against predators like birds, lizards, etc. As regards the controlling measures, the larval stage of a parasitic wasp has been found useful.

Keywords: New record, *Amata passalis*, Bihar.

Comparative physiological and biochemical adaptations of the green and red ecotypes of napier grass to salt and waterlogged stress

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ABSTRACT

This study aimed to evaluate the responses of two varieties of napier grass (green and red ecotypes) to salt and waterlogged stress, while examining their physiological and biochemical traits. The research focused on several key parameters, including chlorophyll content (Chl), ion content, methylglyoxal (MG), malondialdehyde (MDA), hydrogen peroxide (H₂O₂), proline content (Pro), and the activities of various enzymes such as catalase (CAT), peroxidase (POD), lipoxygenase (LOX), and superoxide dismutase (SOD). About 100 and 150 mM NaCl was imposed on plants and for water logged, plants were submerged in water for 11 and 22 days. This experiment was mainly done with two types Napier ecotype. The results indicated that salt stress significantly diminished Chl in both varieties, with the red ecotype showing a more pronounced reduction. Sodium ion concentrations were notably higher in both genotypes under salt stress compared to waterlogged conditions. Furthermore, oxidative stress markers, including MG, MDA, and H₂O₂, were elevated, particularly impacting the green ecotype. The pro content, associated with stress tolerance, accumulated more in the green ecotype under both stressors. Enzymatic activities displayed variable responses, like salt stress increased the activities of CAT, POD, LOX, and SOD, with the green ecotype exhibiting higher levels, especially in CAT and POD. In contrast, both varieties showed reduced enzymatic activity under waterlogged conditions, particularly the red ecotype. Overall, the green ecotype demonstrated greater tolerance to salt stress, while the red ecotype was more resilient to waterlogging.

Keywords: Abiotic stress, Reactive oxygen species, Antioxidant defense, Ion accumulation, Chlorophyll content, Methylglyoxal detoxification

Landslide susceptibility modelling in the eastern slope of the Western Ghat, Kerala, India, using data data-driven method.**Girish Gopinath***Department of Climate Variability and Aquatic Ecosystems, Kerala University of Fisheries and Ocean Studies (KUFOOS), Pudukkottai Campus, Kochi -682 508***ABSTRACT**

One of the ecological hot spot in the globe, the Western ghat, is currently undergoing tremendous pressure due to rapid urbanization associated with alterations in slope and changes in monsoon patterns. In which the eastern slope landslide in the Wayanad plateau in 2024 having a unique significance in the Indian landslide history. This doublet event, associated with Landslide Lake Outburst Flood (LLOF), took several lives and many infrastructures. In this regard, accurate and robust landslide susceptibility models are essential for regional risk assessment and management. In the present study, a data-driven classifier is used for the susceptibility model for the Wayand district of Kerala, India. Wayanad witnessed many devastating landslides from 2018–2024 due to extreme climatic events, and the absence of an accurate landslide susceptibility model contributed to extensive casualties. A geospatial database was created using more than two hundred and sixty previous landslide events and twelve geo-environmental variables, including lithology, soil texture, land use/land cover, slope angle, slope aspect, topographic wetness index, distance from roads, distance from streams, distance from lineaments, convergence index, and profile and plan curvatures. The random forest model utilized a grid search to determine optimal hyperparameters, and the training data was split for 5-fold cross-validation. The best model was selected based on minimal log loss, root mean square error (RMSE), and the maximum area under the curve (AUC) values. The results were validated using receiver operating characteristic (ROC) curves (AUC) and confusion matrix-based metrics. The RF model achieved 91.1% accuracy (AUC = 0.911) in the training frame and 85% accuracy during validation. Although spatial overfitting was observed in the RF model, the results demonstrate its utility for landslide susceptibility modelling. The proposed RF model provides a reliable foundation for future hazard mitigation and land-use planning in the study area. The map also predicted the recent Wayanad landslide region as a highly landslide susceptible area.

Olea europaea* leaf extracts: Effects of seasonal variation on phytochemical constituents and anticandidal efficacy of its different cultivars*Mohd Sajjad Ahmad Khan****Department of Basic Sciences, Deanship of Preparatory Year and Supporting Studies, Imam Abdulrahman Bin Faisal University, P.O. Box 1982, Dammam, 34212, Saudi Arabia***Purpose**

Olive (*Olea europaea* L.) is one of the important agricultural and medicinal tree species. This study aimed to assess the antifungal efficacy of olive leaf extract (OLE) obtained from different cultivars and during different seasons against *Candida albicans* strains.

Materials and Methods

OLE was prepared using four olive cultivars ('Koroneiki', 'Mission', 'Rowghani', and 'Zard') obtained in two seasons (spring and autumn) from Golestan province, North of Iran. The phenolic and oleuropein contents of vegetative leaves were measured by colorimetric and HPLC techniques, respectively. The antifungal capacities of OLEs were tested by agar well diffusion, and the minimal inhibitory concentration (MIC) was evaluated by microdilution assay.

Results

The findings of our study showed that the total phenolic (27.45-88.16 mg g⁻¹) and oleuropein (3.64-18.13 mg g⁻¹) contents varied in leaf extracts, respectively. The highest amount was found in

‘Koroneiki’ and ‘Zard’ (spring leaves), and the lowest in ‘Mission’ cultivars (autumn leaves). The inhibition zones and MIC ranged from 1.92 to 15.41 mm and from 6.07 to 27.20 mg mL⁻¹ based on *C. albicans* strains, respectively. Relationship between total phenolic content as an independent variable (X) and inhibition zones or MIC as dependent variables (Y) fitted polynomial curves.

Conclusions

The present study highlighted the phytochemical and anti-candidal efficacy of OLE derived from olive cultivars or the seasons of harvested leaves against *C. albicans* strains. It is suggested that ‘Koroneiki’ and ‘Zard’ cultivars, especially during the spring season, could be exploited to isolate potential broad-spectrum antifungal drugs.

Keywords: Antioxidants, Antifungal agent, *Candida albicans*, Oleuropein, Olive leaf extract

Soil Physicochemical Properties and Earthworm Abundance under Varying Land-Use Patterns: Insights from Central Nepal

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ABSTRACT

Earthworms, vital for converting organic matter in soil, face declining populations due to soil pollution and land-use changes. This study in the Trishuli River basin, central Nepal, explored how soil properties across various land-use types and elevational gradients affect earthworm abundance. Using stratified random sampling, three elevational strata were defined across the river basin: low elevation (<1000 m asl), mid elevation (1000–2000 m asl), and high elevation (>2000 m asl). Land-use types included cropland, fallow land, forest, near-stream, and roadside areas to capture diverse habitats and nutrient variations. In each stratum and land-use type, 34 pits (25×25×25 cm³) were excavated, earthworms were manually counted and released, and ~300g soil samples were collected for lab analysis of soil physico-chemical properties such as pH, NPK, organic matter, etc. Statistical tools, including generalized linear mixed models and PCA in R-Studio, were used to analyze data. Results showed a slight increase in earthworm abundance with higher soil pH, significant only in fallow land and near-stream habitats at high elevations. Soil organic matter significantly boosted earthworm abundance across all habitats and elevations. Notably, higher soil nitrogen levels strongly correlated with increased earthworm abundance, indicating earthworms' role in balancing soil nitrogen. However, soil potassium and phosphorus showed no significant direct association with earthworm abundance, though their interaction with elevation was notable. Soil temperature (at 15 cm depth) had no significant effect on earthworm abundance. While elevational gradients alone did not significantly affect earthworm abundance, habitat types across different elevations showed significant variations. These findings highlight earthworm habitat preferences and the challenges posed by varying soil nutrients and land-use types. They underscore the need for habitat management and ecosystem restoration to conserve soil biota.

Keywords: Earthworm abundance, Soil Nitrogen, Organic matter, Central Nepal.

Caffeic Acid Attenuates Cadmium-Induced Oxidative Stress in Mungbean by Activating Antioxidant Defense**Kamrun Nahar, Sawrab Mia, Iya Mou Mitu, Kamal Uddin Ahamed***Department of Agricultural Botany, Faculty of Agriculture, Sher-e-Bangla Agricultural University, Dhaka-1207, Bangladesh.***ABSTRACT**

Contamination of soil or water bodies by cadmium (Cd) has become a serious health hazard as a result of products discharged from rapidly growing industries, raw city effluents, and the fertilizer industry. Caffeic acid (CA) is a major hydroxycinnamic acid, widely distributed in plant tissues. It is a precursor of polyphenols and many secondary compounds that regulate plant defense responses. The present study investigated the role of CA (100 μ M) in mitigating the Cd (1.5 and 3.0 mM)-induced damage in mungbean (*Vigna radiata* L. cv. BARI Mung-6) plants. Cadmium is readily accumulated in plants and causes biochemical and physiological disorders. Cadmium decreased different growth parameters like plant height, number of leaves, number of branches, and dry weight. The relative water content (%RWC), chlorophyll content, and membrane stability index (MSI%) were decreased due to Cd exposure. Cadmium imposition increased MDA, H₂O₂, proline (Pro), and glutathione (GSH) levels but decreased ascorbate (AsA) levels. Yield attributes (No. of pod plant⁻¹, No of seed pod⁻¹, pod length, 1000 seed wt.) and yield (pod and stover yield) decreased due to exposure to Cd stress. In contrast, the CA application with Cd treatment enhanced the antioxidant defense system and reduced oxidative stress. Accumulating Pro, the %RWC was increased in CA-treated Cd-affected plants. Exogenously applied CA with Cd treatment also increased the growth parameters, yield contributing characters, and finally the yield of mungbean plants, than those treatments without CA application.

Keywords: Phenolic compound, heavy metal, antioxidant defense system, legume, abiotic stress

Harnessing Plant Breeding and Genetics for Climate-Resilient Agriculture and Global Food Security**Aqib Rasheed^{1*}, Muhammad Saad Rubbani², Muhammad Bilal Khan¹, Muhammad Awais², Abdul Wahid² & Laraib Chouhdary³**¹*Department of Plant Breeding and Genetics, University of Agriculture, Faisalabad*²*Department of Agronomy, University of Agriculture, Faisalabad*³*Department of Botany, University of Agriculture, Faisalabad***ABSTRACT**

Climate change represents an unprecedented danger to world agriculture, severely compromising the productivity of plants and food security. The rising temperature, altered patterns of rainfall, and higher levels of extreme events like droughts, floods, and heatwaves have caused disturbances in the growing patterns of crops, decreased yields, and stressed natural resources. These climatic stresses not only impact the plant physiological processes but also enhance the infestation of pests and diseases, further straining world food systems already under strain from an expanding population. At the top of the most pressing challenges is the necessity to create crop varieties with an ability to endure these interdisciplinary stressors and, at the same time, uphold or enhance yield and quality. Plant breeding and genetics, therefore, come into the limelight at this point. By combining conventional breeding with cutting-edge molecular tools like marker-assisted selection, genomic selection, and CRISPR/Cas-based gene editing scientists can now speed up the development of climate-resilient cultivars. These are crops with improved tolerance to heat, drought, salinity, and new pathogens. In addition, using the genetic diversity of crop wild relatives and landraces creates new opportunities for improvement in traits, such that resilience is incorporated into the genetic base of crops. This complementarity of traditional

practices and new genomic advances is the basis of climate-smart agriculture. These adaptive breeding approaches are critical not just for protecting crop yield in climatic uncertainty but also for enhancing food systems and providing long-term sustainability. With the planet facing the cascading impacts of climate change, the role of plant breeding and genetics will be more critical than before. A concerted effort by all countries across research, policy, and innovation is necessary to give agriculture the capabilities it requires to ensure food's future in a warmer world.

Keywords: Climate Resilience, Food Security, Sustainable Agriculture, Molecular Breeding, Genomic Tools

Exogenous Silicon Modulates the Antioxidant Defense and Morphophysiology in Napier Grass During Drought Stress and Its Recovery

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ABSTRACT

Plants activate different mechanisms through physiological and biochemical processes to mitigate adverse conditions like drought. As silicon (Si) has shown its potential in mitigating various abiotic stress-induced damages in many plant species, our present study was done to focus on how the foliar application of exogenous Si (silicon dioxide, SiO₂; 1 mM) might help napier grass (*Pennisetum purpureum*) seedlings (10-day-old) to better withstand drought stress. For this, the seedlings were exposed to drought for two durations—15 days and 25 days—and then irrigated to observe how well they recovered over the next 15 days. Consequently, Drought stress led to significant reductions in key morphological, physiological, and biochemical parameters. Due to exogenous Si treatment, oxidative stress markers such as malondialdehyde and hydrogen peroxide was reduced by 17% and 48% respectively, whereas the up-regulation of the antioxidant components including the activities of enzymes such as ascorbate peroxidase (38%), monodehydroascorbate reductase (46%), and glutathione reductase 18% and non-enzymes like ascorbate (94%) and glutathione (7%) were noticed. Moreover, the application of Si enhanced the activities of glyoxalase I and glyoxalase II and detoxified the toxic methylglyoxal. During the recovery phase, Si supplementation not only lowered proline content but also promoted the activity of non-enzymatic antioxidants. Furthermore, the activities of enzymatic antioxidants, such as superoxide dismutase, were enhanced, while potassium ion content remained unchanged across all treatments during recovery. To summarize, foliar application of SiO₂ significantly enhances the drought tolerance of napier grass seedlings by strengthening both the antioxidant defense system and the glyoxalase pathway, thereby reducing oxidative damage, mitigating MG toxicity, and improving growth and biomass accumulation.

Keywords: Abiotic stress; drought; oxidative stress; silicon; antioxidant defense system; glyoxalase system

Stakeholders' Perspectives on Improving Soil Health and Sustainability from the Living Soil Laboratory Workshop**Sadiye Kibritçi and İbrahim Ortaş***Department of Soil Science and Nutrition, Faculty of Agriculture, Çukurova University, Adana/Türkiye.***ABSTRACT**

The Living Soil Laboratory (LSL) workshop was held on 8 February 2025 at Çukurova University in Adana, as part of the European Union-supported SUS-SOIL project. The main focus of the workshop was to raise public awareness of the ecosystem services provided by soil and to promote soil health through agroecological approaches. The event was attended by 56 participants, representing academia (54.4%), farmers (22.8%), the public sector (19.3%), industry (3.5%), and students. Sixty-five per cent of the participants were male and 35 per cent were female. Three surveys were conducted among workshop participants to assess their awareness of soil health and sustainable agriculture, their user needs, and business models for farmers and landowners. Additionally, a feedback survey gathered participants' opinions on the effectiveness of the workshop.

Participants ranked soil health-related issues in the following order of importance: erosion, climate change impacts, and declining soil biodiversity. Among the main causes of soil degradation, by cultivation, the conversion of natural areas into agricultural land was identified as the most significant risk factor. The most important goals identified by participants included reducing desertification, improving soil structure, and preserving organic carbon. Furthermore, participants noted that the Living Soil Laboratory contributed significantly to fostering a culture of information sharing and joint decision-making.

In a survey on soil health databases and information platforms, most participants indicated that they were previously unfamiliar with platforms such as EU-FarmBook. Nevertheless, there was a strong interest in using digital platforms. Participants particularly preferred keyword search and filtering techniques for accessing these platforms. Regarding expectations for the Decision Support System (DSS), participants highlighted the need for region-specific fertilization guides, crop rotation strategies, and risk analyses. The greatest challenge noted was the interpretation of the results obtained.

Post-workshop feedback showed a high level of satisfaction. Ninety percent of participants found the workshop duration appropriate, 80% considered the content relevant, and 70% rated the organization as successful. Survey results indicate that farmers and producers are sensitive to soil health and sustainability, and emphasise that in-situ soil conservation is essential for addressing future climate change challenges.

Keywords: Soil health, sustainability, climate change, human effects, ecological survey.

This Research was supported by HORIZON-MISS-2023-SUSSOIL-01-01.

Association studies between seedling traits and phenology of different wheat genotypes**Dinesh Khanal***Department of Genetics and Plant Breeding, Agriculture and Forestry University, Rampur, Chitwan, Nepal***ABSTRACT**

To assess the performance of seedling traits and phenological traits of thirty bread wheat genotypes, including the check variety WK1204 obtained from Agri-Botany Division, Khumaltar, this research was carried out at Jharuwarai, Lalitpur, during the wheat season 2019/2020. The experiment was laid out in a Randomized Complete Block Design (RCBD) with two replications. Seedling traits were taken at Zadok's growth stage 11. Analysis of variance showed significant differences among the genotypes for

coleoptile leaf length, days to emergence, days to booting, days to heading, and days to anthesis, while no significant differences were observed for root length and number of roots. The longest coleoptile leaf length was found in WK 3493(13.05cm), and shortest length in WK 3477 (7.8cm). Days to booting, heading, and anthesis were earlier in WK 3477, while late in WK 1204 Genotype. WK 3490 emerged earlier (6 days) while WK 3479 emerged late (9.5 days). Correlation analysis revealed a significant correlation between phenological traits, with no significant interrelationship observed between phenological traits and root length, coleoptile leaf length, and number of roots. The highest significant correlation was observed between days to heading and days to anthesis (0.955). From our findings, although diversity was present among the genotypes for seedling traits, we found that the studied seedling traits did not significantly affect the phenological traits.

Keywords: Root length, coleoptile leaf, days to emergence

Insights Into the Role of Silymarin in Modulating Reactive Oxygen Species Metabolism and Improving Plant Morphophysiology Towards Conferring Salt Tolerance in Rapeseed (*Brassica napus*)

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ABSTRACT

Salinity, a major threat to sustainable agriculture worldwide, promotes the accumulation of reactive oxygen species (ROS), resulting in restricted productivity of crops, including rapeseed. However, as a strong antioxidant, silymarin can enhance this ROS-scavenging defense system. The present study investigates the regulatory role of exogenous silymarin in enhancing the antioxidant defense system and morpho-physiology of rapeseed under salinity stress. Twenty-three-day-old rapeseed (*Brassica napus* cv. BARI Sarisha-18) was supplemented with a foliar spray of 0.06% silymarin followed by two doses of NaCl, viz. 75 and 150 mM, and subjected to grow under such conditions for an additional 30 days. Salinity resulted in reduced biomass production, growth attributes, and relative water content of rapeseed plants with increased levels of Na⁺ ions, hydrogen peroxide (H₂O₂), lipid peroxidation (MDA), electrolyte leakage (EL), and proline (Pro) content. This led to oxidative damage by suppressing antioxidant enzyme activity. Application with silymarin reduced MDA, H₂O₂, EL, and Pro content by 23, 15, 9, and 17% in 150 mM NaCl-stressed plants compared to their corresponding controls. This response lessened salinity-induced damage by uplifting water uptake and redox level of ascorbate and glutathione. The activities of glyoxalase, as well as antioxidant enzymes such as ascorbate peroxidase, monodehydroascorbate reductase, dehydroascorbate reductase, glutathione reductase, catalase, glutathione peroxidase, glutathione S-transferase, peroxidase, and superoxide dismutase were also ameliorated due to foliar application of silymarin. Findings from the current study suggest that salt-induced rapeseed plants exhibited reduced growth attributes alongside elevated oxidative stress markers, including both enzymatic and non-enzymatic antioxidants. Furthermore, it highlights the potential of silymarin as a growth regulator and antioxidant that can enhance salinity tolerance in rapeseed plants by reducing the harmful effects of ROS under saline conditions.

Keywords: Flavonoids, ROS, salinity stress, oilseed, *Silybum marianum*, AsA-GSH pathway, ion homeostasis

Multidimensional Impacts of Climate Change: Ecosystem Disruption, Biological Adaptation, and Medicinal Plant Vulnerability**Muhammad Mujtaba^{1*}, Muhammad Bilal Bashir², Fatima tul Kubra¹, Mubashir Sharif³, Muhammad Hassnain Sardar², Omer Farooq², Aroma Afzal¹**¹*Department of Plant Breeding & Genetics, University of Agriculture, Faisalabad*²*Institute of Biological Sciences, Khwaja Fareed University of Engineering and Information Technology*³*Department of Plant Pathology, University of Agriculture, Faisalabad***ABSTRACT**

Climate change presents an escalating global crisis, manifesting through rising temperatures, altered weather patterns, and intensified ecological stress across diverse systems. Interdisciplinary perspectives highlight the consequences of anthropogenic activities such as fossil fuel combustion, deforestation, and unregulated urbanization, which have accelerated greenhouse gas emissions and led to widespread disruption of ecological balance and biodiversity. Particular attention is given to the phenotypic responses of organisms, including shifts in body size and shape driven by endocrine signaling pathways like the insulin-like growth factor-1 system, offering a mechanistic view of biological adaptation to thermal stress. Additionally, the increasing vulnerability of wild medicinal plant species is examined, as climate-induced abiotic stressors and habitat degradation compromise their distribution, secondary metabolite production, and medicinal value. The overall findings emphasize the urgency of integrated scientific inquiry and policy action to foster climate resilience, ensure sustainable resource use, and protect ecologically and economically important species. Coordinated global efforts are essential to minimize long-term damage and strengthen adaptive capacities across both natural and human systems.

Keywords: Climate change, ecosystem disruption, phenotypic adaptation, medicinal plant vulnerability**The Effects of Long-Term Organic and Mineral Fertilizer Applications on the Mineral Nutrient Concentration and Carbon-Nitrogen Dynamics of Fava Beans****Veysi, Akşahin¹, Mehmet Işık¹, Sadiye Kibritçi¹, İbrahim Ortaş¹**¹*Department of Soil Science and Plant Nutrition, Faculty of Agriculture, Çukurova University, Adana-Türkiye.***ABSTRACT**

This study investigates the long-term effects of mineral and various organic fertilizers (animal manure, compost, and mycorrhizae) applications on yield, nutrient uptake, and soil properties of faba bean (*Vicia faba* L.). A long-term field experiment was established in 1996 at Cukurova University Research Centre, Adana/Türkiye. Since then, for each cropping season: Control (no fertilizer), Mineral fertilizer (NPK), Animal Manure (25 t ha⁻¹), Compost (25 t ha⁻¹), and Compost (10 t ha⁻¹) + Arbuscular Mycorrhizal Fungi treatments were applied. In the present research, faba beans were grown in 2021 winter and harvested in 2022 spring of 2022. At harvest, shoot, root dry weight seed yield were measured. Plant tissue mineral nutrients were determined, and plant total nitrogen and carbon uptake were calculated.

The highest mycorrhizal root infection rate was recorded with compost+mycorrhiza at 65%, while the lowest was observed in control plots at 31%. Dry matter weight of shoot biomass was highest with compost at 11.35 tons/ha and lowest in the control group at 6.81 tons/ha. Grain yield reached 9.77 tons/ha with compost and only 5.32 tons/ha in control. Total biomass yield was highest with compost at 22.23 tons/ha, compared to 13.09 tons/ha in the control plots. The highest nitrogen (N) concentration in plant tissues was 5.26% in compost+mycorrhiza treatment, while the highest grain nitrogen content was 0.37 t N/ha in compost application. In terms of carbon (C) accumulation, compost-treated plants stored 8.65 t C/ha, equivalent to 31.73 t CO₂/ha. In comparison, control plots stored only 5.49 t C/ha (20.13 t CO₂/ha). Fertilizer application significantly increases shoot, K, P and Zn, and root P and Zn

concentrations. Root diameter reached the highest value (0.58 mm) in the compost+mycorrhiza treatment and the lowest (0.35 mm) in the control. In conclusion, organic fertilizers such as compost and animal manure positively influenced both plant yield and nutrient quality. These results demonstrate that long-term organic fertilization significantly enhances biomass and seed yield and mineral nutrient concentration, especially under compost and compost + mycorrhizae treatments. Organic fertilisers fixed significantly more CO₂ compared to control treatments, which is important to combat climate change caused by greenhouse gases.

Keywords: Faba bean, root infection, organic and mineral fertilizer, carbon fixation, nitrogen, yield.

Note: This work was supported by PRIMA SHARInG-MeD -2211, also the work was also supported by Cukurova University Scientific Research Unit, Project no: FAY-2022-15344

Comparative Morphophysiology, Ion Homeostasis, Water Relations and Antioxidant Metabolism in *Chenopodium quinoa* and *Chenopodium album* in Response to Salinity and Drought

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ABSTRACT

Plant responses and adaptations to environmental stresses like salinity and drought involve a wide spectrum of cellular, physiological, and biochemical changes. Understanding these mechanisms is crucial for developing effective strategies to alleviate such stresses. Salinity and drought adversely impact plant growth and metabolism by inducing dehydration, ionic toxicity, and oxidative stress. This study aimed to compare the biochemical responses of *Chenopodium quinoa* and *Chenopodium album* under salt and drought stress. Thirty-day-old seedlings of *C. quinoa* and *C. album* were subjected to salt stress by irrigation with 500 mM NaCl, and drought by maintaining soil moisture of 15%. The relative water content was notably declined in *C. album* under drought. In response to osmotic shock, *C. album* accumulated a higher amount of proline as an osmoprotectant. A similar response was also observed in *C. quinoa*, though with lower proline accumulation. *C. album* exhibited greater susceptibility to drought-induced oxidative stress, indicated by higher malondialdehyde and hydrogen peroxide levels, whereas *C. quinoa* suffered less damage, as shown by lower accumulations of these compounds. The antioxidant defense system was greatly hampered under salt and drought stress. In drought-affected *C. quinoa*, the ascorbate and ascorbate/dehydroascorbate ratio declined more significantly, whereas under salt stress, the glutathione and glutathione/glutathione disulfide ratio were reduced. Enzyme activities of ascorbate peroxidase, superoxide dismutase, and peroxidase increased under both stresses, whereas monodehydroascorbate reductase, dehydroascorbate reductase, glutathione reductase, glutathione peroxidase, glutathione S-transferase, and catalase activities declined, with more noticeable reductions under drought. Both stresses also led to increased methylglyoxal accumulation due to decreased the activities of glyoxalase I and glyoxalase II. Under salt stress, *C. quinoa* accumulated higher Na⁺ levels and reduced K⁺, thus increasing the Na⁺/K⁺ ratio. These findings suggest that *C. quinoa* and *C. album* are more susceptible to drought than salt stress.

Keywords: Ionic stress; osmotic stress; antioxidant defense; oxidative stress; methylglyoxal detoxification

Spatiotemporal Analysis of Air pollutants (NO₂ and SO₂) and Their Correlation with Rainfall in Major Districts of Punjab, Pakistan: A Remote Sensing perspective**Muhammad Asif Javed and Aliza Aziz***College of Earth and Environmental Sciences, University of the Punjab, Pakistan.***ABSTRACT**

Air pollution and the resilience to climate change pose notable risks to the environment and public health in areas that encounter fast metropolitan growth. This research investigates the link between nitrogen dioxide (NO₂), sulfur dioxide (SO₂), and precipitation progressively and spatially in four major districts of Punjab, Pakistan, Lahore, Faisalabad, Rawalpindi, and Multan from 2020 to 2024. Satellite-derived data were gathered using Google Earth Engine (GEE), utilizing Sentinel-5P Level 3 products for NO₂ and SO₂, while precipitation data were acquired from the Climate Engine. Monthly averages were used to estimate year-to-year variations. Spatial analysis was performed with ArcGIS, where raster layers were set with district boundaries. Time-series visualizations and zonal statistics were employed to recognize both temporal and spatial patterns.

The results exhibit notable deformity in pollutant levels and precipitation across several districts. In January 2024, Faisalabad recorded higher SO₂ levels compared to 2020, whereas Rawalpindi experienced a substantial lessen in rainfall during the same period. Multan indicated a decline in precipitation mid-year, indicating changes in monsoonal patterns. Lahore encountered a major increase in SO₂ levels in early 2024, likely connected to a rise in combustion activities and adverse atmospheric conditions. These trends were recognized through geospatial mapping and time-series analysis, offering a beneficial understanding of emission trends and climatic variations. By combining satellite remote sensing, cloud-based data analysis, and GIS-based spatial modeling, this research expands a data-driven method for employing urban environmental shifts. The results underline the basics of ongoing spatial and temporal monitoring to guide policy development, reinforce adaptive management, and increase the urban climate resilience approach in Punjab.

Keywords: Spatio-temporal analysis, Air pollutants, Google Earth Engine, Climate Engine, Remote Sensing, Rainfall Correlation

Evergreen revolution: pathway to mitigate climate change consequences
Md. Mizanul Haque* and Swaraj Kumar Dutta*Bihar Agricultural University, Sabour, Bhagalpur, 813210, Bihar, India***ABSTRACT**

Indian agriculture, contributing 18.3% to the national Gross Value Added (2022–23) and employing over 43% of the workforce, stands at a critical juncture where productivity gains must be sustained without further ecological degradation. Despite achieving remarkable gains since the Green Revolution—raising foodgrain production from 82 million tonnes in 1960–61 to 330 million tonnes in 2022–23—India faces escalating challenges, including 78% groundwater depletion in Punjab, degradation of ~30% of total geographical area, and a worrying decline in soil organic carbon (SOC) to <0.5% in parts of the Indo-Gangetic Plains (FAO, 2021; MoAFW, 2023).

Climate change adds a new layer of urgency, with projections indicating a 6–10% decline in crop yields by 2030 due to rising temperatures, erratic rainfall patterns, and an increase in extreme weather events (World bank, 2022; IPCC, 2023). In this context, the concept of the Evergreen Revolution, articulated by Dr. M.S. Swaminathan, offers a transformative pathway for sustainable productivity growth without environmental harm (Swaminathan, 2010). Unlike the input-intensive Green Revolution, the Evergreen Revolution emphasizes climate-smart intensification, ecosystem restoration, and resilience building.

Drawing on multi-year field trials, case studies from the National Innovations on Climate Resilient Agriculture (NICRA, 2023), and policy initiatives under the National Mission on Sustainable Agriculture (NMSA), several scalable interventions emerged as promising technologies for sustainable intensification. These include zero tillage, direct-seeded rice, residue management, integrated nutrient management, green manuring, biofertilizers, micro-irrigation, laser land levelling, alternate wetting and drying, agroforestry, and diversified cropping systems (FAO, 2021; NICRA, 2023).

Such measures have been shown to reduce irrigation water demand by 15–20%, enhance cereal yields by 8–12% and pulse/oilseed yields by 15–20%, reduce greenhouse gas emissions through optimized input use, and sequester 2–4 tonnes of carbon per hectare per year via agroforestry and conservation agriculture (Lal, 2004). Income diversification through integrated farming systems has further improved farm incomes by 20–25%, demonstrating both economic viability and environmental sustainability (Singh *et al.*, 2020).

Successful scaling examples from Bihar, Haryana, and Andhra Pradesh underline the importance of institutional support through Farmer Producer Organizations (FPOs), digital advisories, and emerging carbon credit mechanisms (CCAFS, 2022). To enable large-scale adoption, policy reforms must reorient subsidies toward low-carbon, resource-efficient technologies, expand research on climate-resilient crop varieties and low-emission mechanization, strengthen capacity building via digital platforms and on-field demonstrations, and institutionalize soil, water, and greenhouse gas monitoring frameworks (NITI Aayog, 2021).

Conclusion

The Evergreen Revolution is not merely an agricultural strategy but a holistic development model that balances productivity, resilience, and environmental stewardship. By embedding climate-smart practices within supportive policy frameworks and ensuring farmer-led innovation, India can mitigate the adverse consequences of climate change, reverse resource degradation, and create a globally relevant template for sustainable agriculture. Scaling these solutions will be pivotal for ensuring food and nutritional security while advancing India's commitments under the Sustainable Development Goals and the Paris Climate Agreement (UN, 2023).

Keywords: Evergreen Revolution, Climate-Smart Agriculture, Carbon Sequestration, Policy Interventions, India

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Exogenous Application of γ -Aminobutyric Acid Enhances Salinity Tolerance in Rapeseed (*Brassica campestris* L.) by Regulating Morphophysiology, Antioxidant Defense, and Methylglyoxal Detoxification System**Umme Kulsum Sabiha¹, Md. Rakib Hossain Raihan^{2,3}, Dipanwita Datta², and Mirza Hasanuzzaman²**¹*Department of Agricultural Botany, Faculty of Agriculture, Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka 1207, Bangladesh*²*Department of Agronomy, Faculty of Agriculture, Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka 1207, Bangladesh*³*Laboratory of Bioclimatology, Department of Ecology and Environmental Protection, Poznań University of Life Sciences, Wojska Polskiego 28, 60-637 Poznań, Poland***ABSTRACT**

The role of γ -aminobutyric acid (GABA) has been emphasized due to its osmoprotective nature under salt to cope with the abiotic stress. To investigate the protective role of GABA which aligned with previous findings, two GABA treatment include priming (0.1 mM) for 3 h and foliar spraying (1mM) at 3 day's intervals were applied on rapeseed variety (BARI Sarisha-17) under salt concentrations (100, 200 mM) in 3 replications. Result showed that under saline conditions morphological growth like root length, shoot length and stem diameter along with yield and yield attributing characteristics like no of silique plant⁻¹, Silique length, no of seed silique⁻¹ etc were affected. Exogenous application of GABA reduced oxidative damage which revealed from biochemical data, showed that stress indicator like lipid peroxidation, hydrogen peroxide and proline level decrease compared to salt treated plant. Besides, chlorophyll pigment, Na⁺/K⁺ ratio, leaf relative water content (RWC) was decreased under stress condition compared to GABA treated plant. Plants treated with GABA reduced buildup of reactive oxygen species (ROS) by regulating the activity of enzymatic antioxidants included superoxide dismutase, guaiacol peroxidase, ascorbate peroxidase, dehydroascorbate reductase, catalase, lipoxygenase, Glyoxalase I and Glyoxalase II and others. Again, GABA increased ascorbate-glutathion level which was an evident to alleviated stress. The result highlighted the recovery of plant growth in response to salinity. The findings revealed GABA's potential as foliar application compare to seed priming showed better result on growth and yield parameters in response to stress in rapeseed.

Keywords: Membrane Stability, Ion Homeostasis, Oxidative Stress, Osmotic Shock, Redox Ratio.**Role of Silicon Nanoparticles in Mitigating Salt Stress in Proso millet****Dipanwita Datta¹ and Mirza Hasanuzzaman¹**¹*Department of Agronomy, Faculty of Agriculture, Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka-1207, Bangladesh*²*Laboratory of Bioclimatology, Department of Ecology and Environmental Protection, Poznań University of Life Sciences, Wojska Polskiego 28, 60-637 Poznań, Poland***ABSTRACT**

Proso millet (*Panicum miliaceum*), as a cereal crop holds potential for food security due to its superior nutritional profile compared to that of other minor cereals. Salinity poses a substantial challenge to crop growth and yield. Silicon (Si) supplementation has been shown to mitigate both biotic and abiotic stresses in plants. This study focused on the effect of silicon as silicon nanoparticles (SiNPs) and silica (SiO₂) on different growth stages of proso millet under salt stress. Experimental treatments included foliar application of SiNPs and SiO₂ using different concentrations (60 and 400 ppm) and induced salinity by applying NaCl (150 mM) with irrigation at vegetative, reproductive, and both stages of proso millet. Results showed that SiNPs and SiO₂ improved morphological growth (plant height, dry weight)

along with yield and yield attributing parameters (panicle length, filled grain panicle⁻¹) under stress conditions. Both SiNPs and SiO₂ alleviated oxidative damage by reducing levels of stress indicators like malondialdehyde, hydrogen peroxide, and proline levels of stressed plant. Biochemical parameters such as electrolyte leakage, chlorophyll pigment, Na⁺/K⁺ ratio, and leaf relative water content (RWC) were improved in SiNPs treated plant. SiNPs reduced reactive oxygen species (ROS) by regulating the activity of enzymatic antioxidants including superoxide dismutase, peroxidase, ascorbate peroxidase, catalase, lipoxxygenase, Glyoxalase I and Glyoxalase II. In conclusion, foliar application of SiNPs showed better results at both stages compared to SiO₂ in response to stress in proso millet.

Keywords: Salinity; Silicon Nanoparticles; Reactive Oxygen Species; Antioxidant Defense System; Glyoxalase System

Assessment of the Impact of Farmer Field School on Goat Farming in the Western Mid-Hills of Nepal

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ABSTRACT

Farmer Field School is an experiential learning approach that utilizes field-based education, community-driven curricula, and hands-on skill development. A study was conducted in 2022 with 120 sample farmers who attended the Farmer Field School (FFS) on goat farming from Salyan, Pyuthan, and Gulmi districts of Nepal to analyze the short-term impacts and technology adoption patterns following the Farmer Field School (FFS) program conducted in the region. A face-to-face interview was conducted to collect the primary data with supporting secondary information from published reports and articles. Focus group discussion and key informants' interviews were employed to get information on in-depth experience of the farmers and their learning from the participation in the program. Both quantitative analyses using statistical tests and descriptive and qualitative observations on the basis of stakeholders' opinions were carried out. Out of the total population, 43.33% of the farmers were female, with the majority, 52.99 % having an education of secondary level and above. The findings revealed that 76% of respondents had good knowledge about FFS principles, and 74% of them correctly recognized high-performance goat breeds. Improved goat-rearing method adoption rates were notably high, which was found to be 96%. The majority (94.16%) have felt the change in value of inputs after FFS. Post-FFS implementation resulted in improvements in breeding efficiency, age of kidding, average weight gain, etc. The results of the study revealed that the FFS participation resulted in a significant change in the farmers' knowledge of shed construction, feed & fodder management, identification of disease/pest, and identification of important growth indicators, ultimately leading to upscaling of Goat production through changes in value of inputs and management for Goat production. The study indicates the potential for adopting experiential learning techniques to drive sustainable livestock development, particularly in areas of limited resources.

Keywords: FFS, Goat, Farming, Knowledge, Management

Developing Selection Indices for Yield, Early Maturing, and Shattering Tolerance in *Brassica napus* L. strains under varying climatic conditions.**M. Ali Zia¹, Haider Ali Aslam², Subhan Ahmad khan¹, Waqar Ul Hassan¹, Laraib Chouhdary³, Noreen Amjad³, Dr. Humera Razzaq¹**¹*Department of Plant Breeding and Genetics, University of Agriculture, Faisalabad.*²*Center of Agricultural Biochemistry & Biotechnology, University of Agriculture, Faisalabad.*³*Department of Botany, University of Agriculture, Faisalabad.***ABSTRACT**

Brassica napus L. (canola/rapeseed) is a globally significant oilseed crop characterized by high oil yield and widespread commercial utilization. It contains beneficial fatty acids, rich in monounsaturated fatty acids and containing omega-3 and omega-6 fatty acids; moreover, it has low erucic acid content. Seed shattering due to pod dehiscence is a critical issue that is the main cause of significant yield loss. This study was aimed at establish selection criteria for high-yielding, early-maturing, and shattering-tolerant lines. This experiment was conducted in the research fields of the Department of Plant Breeding and Genetics, utilizing the Randomized Complete Block Design (RCBD) with three replications. In this experiment, 150 diverse accessions were screened, and data on morphological traits, including plant height, shattering percentage, number of primary and secondary branches, days to maturity, and oil-related traits, were measured and analyzed using ANOVA, Correlation, and Principal Component Analysis. Results revealed highly significant for all evaluated traits. Analysis of variance showed genetic variation for plant height (187.3 to 267.9 cm), days of maturity (119 to 145 days), and shattering percentage (12.7 to 67.8 %). Moreover, oil content also varies significantly from 38.7 to 46.2%. Strong and positive Correlation between plant height and seed rate, while negatively significant with shattering percentage. Principal Component Analysis revealed three major components explaining 67.3% of the total variation. PC1 (32.1% variance) was primarily loaded by yield-related traits, PC2 (20.7% variance) by maturity and shattering tolerance, and PC3 (14.5% variance) by oil quality parameters. Research has built an effective approach for *Brassica napus* L. breeding through systematic identification of high-yielding, early-maturing, and shattering-tolerant genotypes, enabling successful oilseed production and sustainable agricultural systems among global markets. The joint effort between improved selection indices, molecular breeding methods, extension services, and government guidelines will lead to the development of superior cultivars, establishing widely adopted, environmentally friendly agricultural solutions for canola cultivation.

Keywords: *Brassica napus*; shattering tolerant; early mature; yield; oil quality**Evaluation Of Yield and Yield Attributing Characters of Barley (*Hordeum vulgare* L.) Genotype in Terai Region****Sapana Chaulagain¹, Bibhor Jayswal¹, Saroj Sapkota², Abhisek Shrestha¹**¹*College of Natural Resource Management, Bardibas, Nepal.*²*Agriculture and Forestry University, Rampur, Nepal.***ABSTRACT**

Barley cultivation in Nepal's Terai region remains underexploited, primarily due to the unavailability of high-performing cultivars, resulting in low productivity and reduced farmer engagement. To address this challenge, a field experiment was conducted during the 2024–2025 cropping season to evaluate the agronomic performance of twenty-four barley genotypes under Terai conditions. The experiment was laid in Randomized Complete Block Design with two replications. The seed was sown on 22nd November 2024, and all cultivation practices were adapted as recommended. Phenology and Yield and yield attributes were collected at time of harvest. Data were entered in MS excel 2007, interpret in MS

word 2007 and analyzed through Gen-stat ver. 2015 and mean separation was done by DMRT at 5% level of significance. The result revealed that Saptari local performed better at plant height, days to heading, flowering, and showed early physiology maturity at 116 days. The 1000 grain weight significantly varies among the genotype where NDB-6 (59.63) possess higher followed by Bonus (35.48) and Saptari local (40.40) and lowest by Xveola-53 (18.17). In terms of grain yield, Saptari Local produced the highest yield (3.33 t/ha), significantly outperforming all other genotypes, whereas Bonus had the lowest (0.57 t/ha). Based on these findings, Saptari Local demonstrates strong potential for barley production in the Terai region and should be considered for further validation through multi-location and multi-year trials.

Keywords: *Genotype; Phenology; Yield attributes; Yield; Barley*

Empirical Assessment of Growth and Trade Patterns in India's Silk Exports and Imports

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EXTENDED SUMMARY

Purpose

Asia is the main producer of silk in the world and produces over 95 per cent of the total global output. India is the second largest producer of silk with 38913 MT (2023-24) after China and also the largest consumer of silk in the world. The mulberry and silk production industry in India is a significant pillar of the nation's agrarian economy and a vital contributor to its textile sector. As the second-largest producer of silk in the world, India plays a crucial role in the global silk market, with mulberry silk accounting for over 70% of the country's total silk output. It provides livelihood for over nine million people, predominantly in rural areas, encompassing farmers, reelers, weavers, and traders. In India, mulberry silk is produced mainly in the states of Karnataka, Andhra Pradesh, Tamil Nadu, Jammu & Kashmir and West Bengal, while the non-mulberry silks are produced in Jharkhand, Chattisgarh, Orissa and North-Eastern states. The major silk producing countries in the world are China, India, Uzbekistan, Brazil, Japan, Republic of Korea, Thailand, Vietnam, DPR Korea, Iran, etc. Analysis of export and import of silk and silk products in India is vital for understanding the dynamics of a significant sector that contributes substantially to the nation's economy, employment, and cultural heritage. As one of the world's largest producers and exporters of silk, India's trade in this sector impacts both the domestic and international markets, with exports ranging from raw silk to finished goods like garments and textiles. Analyzing trade patterns helps identify key markets, assess global demand, and optimize product offerings to stay competitive.

Material and Methods

The present study is based on secondary data. The secondary data on sericulture exports and imports, year-wise and country-wise exports and imports of sericulture products in terms of value were collected from various published sources like, Central Silk Board, Export Import data bank- Ministry of Commerce and Industry, etc. The data has been collected for 6-10 years based on the availability of data. The techniques like Compound Annual Growth Rate (CAGR), Cuddy-Della Valle Index (CDVI) and Markov Chain approach were used for the analysis of the data.

Results

From 2017-18 to 2023-24, India's silk industry showed steady growth in mulberry plantation (2.33% CAGR) and bivoltine cocoon (7.37%) and silk (7.81%) production, albeit with high variability. Cross-breed and multivoltine segments grew modestly but were more stable. Vanya silk, especially tasar, declined sharply (-14% CAGR), while eri and muga showed low, stable growth. Silk exports grew in value (1.46%) but declined in volume (-2.42%), with high variability. Imports saw rising costs but reduced quantities, highlighting supply disruptions. Export earnings shifted, with China, USA, and UAE

retaining shares, while UK, Germany, and France declined. Imports diversified from China to Vietnam, Uzbekistan, and Brazil, indicating changing trade patterns. The silk sector faces volatility across production and trade, requiring focus on market diversification, innovation, and stabilization strategies to sustain future growth.

Conclusions

Between 2017-18 and 2023-24, India's silk industry saw steady growth in mulberry cultivation, bivoltine cocoon and silk production and employment, though variability persisted due to weather, costs and market shifts. Vanya silk, especially tasar, declined sharply. Exports showed mixed results growth in China and Australia but declines in the UK and Germany, while imports shifted from China to Vietnam and Brazil amid high volatility. Transitional Probability Matrices revealed market diversification in both exports and imports. These trends indicate structural changes in the industry. To sustain growth, India must enhance domestic production, adopt new technologies and diversify trade partnerships, ensuring resilience against market instability and global competition.

Keywords: *Indian silk industry; silk exports; silk imports; market volatility; Transition Probability Matrix; market diversification*

Enhanced Soil Carbon Dynamics Under Long-Term Organic Versus Mineral Fertilization Under Faba Bean Cropping System

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Purpose

Long-term fertilization is a key factor that affects soil health, particularly by altering soil organic carbon (SOC) dynamics, nutrient balance, and carbon cycling. And understanding the response of SOC fractions and indices to fertilization regimes, which is important for evaluating the effectiveness of soil management strategies. This study investigated the impacts of long-term mineral and organic fertilizers application on nitrogen, SOC dynamics and carbon dioxide flux under a faba bean cropping system.

Material and Methods

A long-term field experiment was established in 1996 at Çukurova University Research Centre, Adana/Türkiye. Since then, continuously five fertilizer treatments have been applied each cropping season: Control (no fertilizer), Mineral fertilizer (NPK), Animal Manure (25 t ha⁻¹), Compost (25 t ha⁻¹), and Compost (10 t ha⁻¹) + Arbuscular Mycorrhizal Fungi. In the present research, faba beans were grown and harvested in 2022. At harvest, 0-20 cm depth soil samples were collected to determine soil total carbon (TC), total nitrogen (TN), organic carbon (OC), permanganate oxidizable carbon (POXC), and stable OC. Moreover, carbon indices, including Carbon Lability Index (CLI), Carbon Pool Index (CPI), and Carbon Management Index (CMI), were estimated to evaluate the quality and stabilization of SOC.

Results

The results showed that organic fertilizers, particularly manure and compost, resulted in significant increases in labile and stable SOC fractions compared to the control and mineral fertilizer applications. These treatments also improved CMI, reflecting enhanced SOC stabilization and management efficiency. Nevertheless, cumulative soil CO₂ flux did not differ significantly among treatments, indicating that increased carbon inputs did not lead to elevated CO₂ emissions under organic fertilization.

Conclusions

The research findings indicate that the relationships between organic carbon fractions and CO₂ flux are driven by practices that utilize the highest organic fertilizer sources. In conclusion, long-term organic

fertilization can improve SOC quality and quantity, making it a promising strategy for sustainable soil management and a climate-resilient agriculture strategy. These findings provide important information about the carbon fractions that contribute to CO₂ gas, one of the greenhouse gases released from the soil into the atmosphere that causes climate change.

Keywords: *Faba bean; Organic and mineral fertilizer; Organic carbon fractions; Soil CO₂ flux*

Priming Agent Enhances the Germination Diversity of Tomato (*Lycopersicum esculentum*) Varieties Seedling

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ABSTRACT

The seed industry and farmers face challenges, including the production of poor-quality and non-certified tomato seeds, which ultimately result in decreased crop production. The issue carefully demands pre-sowing treatments using exogenous chemical that promotes germination and plant growth. Therefore, to mitigate the above-stated problem, selection of variety of tomatoes (Srijana, Suman and Purbely Cheury tomato) and priming agents potassium nitrate (KNO₃) at 500ppm and 750ppm, soaked for 24 h and then dried before experiments and control. Then the seeds are sown in tray of 20 seeds of each treatment in CRD experimental design with three replications. The data was collected and entered in MS excel and analyzed by GenStat ver. 2018. All the germination parameter was collected, and DMRT did mean separation at 5% level of significance. The results showed that Srijana performed better in germination parameter as compared to other. The germination % of Srijana (70%) treated with 500 ppm KNO₃ performed better as compared to unprimed suman (38.35%). The mean germination time is significantly influenced by the priming material, Both the concentration of KNO₃ reduced the time of germination than that of unprimed or check. The KNO₃ declined the mean germination time by 18% and enhanced the seedling height by 60% as compared to control. So, use of priming agent KNO₃ (500 ppm) enhances the germination parameter of tomato varieties. At conclusion, the further experiment should be conducted in farmer field and focused on physiological part.

Keywords: *Tomato; Variety; Priming; Germination; KNO₃*

Climate Resilient Agricultural Technologies for Bundelkhand Agro-Climatic Zone of Madhya Pradesh, India in context of climate change

R.K. Prajapati, B. S. Kirar and Jaipal Chhigarha

J N K V V, Krishi Vigyan Kendra, Tikamgarh (M.P.), India.

EXTENDED SUMMARY

Introduction

Madhya Pradesh is the country's second largest state in terms of land area and its population surpassed 60 million, accounting for 5.88% of the country's total population. The state is located between latitudes 21°6' and 26°54' north and longitudes 74° and 82° 47' east and spreading over geographical area of about 3,08,245 sq.km, which is 9.38% of India's total area. (State Perspective and Strategic Plan (SPSP) of Madhya Pradesh, Dept. of Land Resources). The State is also divided in 11-Agro-climatic zones. The total cultivated area of the state is 151.91 lakh ha with a gross cropped area of 228.46 lakh ha and forest area of 85.87 lakh ha. The cropping intensity in the state is 165.7 percent. Other land use like permanent pastures and other grazing lands, land under misc. tree crops and groves, culturable waste land, fallow lands other than current fallows, current fallows cover about 13.21, 0.21, 10.55, 5.10, 5.39 lakh ha area of the state, respectively. (State Agriculture Infrastructure Development Plan 2012-17, Madhya

Pradesh). Madhya Pradesh has a sub-tropical climate with three seasons: winter (December to February), summer (March to May) and the rainy season (June to October). In winter, the mean minimum temperature is 10°C, and rise to a mean maximum temperature of 25°C. Summer temperatures fluctuate between a minimum of 22°C and a maximum of 38°C, though it can get very hot with temperatures up to 48°C. The humidity is relatively very low and the region usually experiences frequent mild dust storms. The South-West monsoon usually breaks out in mid-June and the entire state receive a major share of its rainfall between June and September. Annual average rainfall for the state is 1160 mm, with the heaviest rains in the south eastern parts and decreasing towards the north-west. Most of the rainfall is received from the South-West monsoon during June to September; which, in Madhya Pradesh, accounts for more than 90% of the total annual rainfall. (Madhya Pradesh State Action Plan on Climate Change; Briefing Note on the Climate Science of Madhya Pradesh).

Madhya Pradesh offers remarkable agricultural diversity, with a wide range of climatic backgrounds within and between crop seasons, a wide range of soil types ranging from light textured soil to very heavy rich clay vertisols soil, each with its own distinctive challenges and cropping patterns. Important soil types in different zones of the states are mixed red and black (Kymore plateau), medium and deep black (Vindhya plateau), deep black with clay (Central Narmada Valley), Alluvial, Medium black soil, Mixed red and Black soil and red and yellow soil (Grid sub zone), clay and clay loams and sandy loam soils (Bundelkhand), light reddish brown to black clay loam (Satpura), Alluvial, Recent alluvium and Calcareous (Food Prone Eastern Plain Zone) (State Farmers Guide, Madhya Pradesh). Agriculture is the mainstay of the state's economy and 74.73 per cent of the population is dependent on agriculture. Madhya Pradesh is the largest producer of pulses, with Gram and Soybean contributing 21.38%, 40.33%, and 59.92%, respectively, and is the second largest producer of oil seeds, with Sorghum and Lentil contributing 22.10, 14.11, and 22.30%, respectively, to India's total production. Soybean, Paddy, Maize, Pearl millet, Pigeonpea and other crops are cultivated during the Kharif season, whereas wheat, gram, mustard, cotton, sorghum and vegetables are planted during the Rabi season. Sugarcane, Custard Apple, and banana are also grown in select areas. The eastern half of the state is distinguished by rice-based cropping systems, light alfisols soil with limited water holding capacity and prone to erosion, mostly due to greater and frequently intense rainfall. Rainfall in this area of the state averages around 1500 mm, with the majority falling during the south-west monsoon season. The state's central and western regions rely on a soybean-based agricultural system, while pulses and oilseeds play a major role in the region. (History & Current Overview in Agriculture; Farmers welfare and Agriculture Development department, Madhya Pradesh)

Climate Change in Madhya Pradesh

The Madhya Pradesh vulnerable to various natural and manmade disasters. There are 28-districts that come under Zone-III and 22 districts come under Zone-II of Earthquake. Likewise in last 26-years there are 32-districts of the State affected from the flood and around 7-districts highly affected from drought. (MPSDMP). Extreme weather conditions such as longer summers, shorter winters/severe winters, excessive/ unseasonal rainfall, and protracted dry spells during the monsoon season are examples of extreme weather occurrences. Changes in temperature and precipitation, as well as general increased uncertainty in weather patterns, are becoming more common in Madhya Pradesh. The rain fall in 2019 was above average, breaking the previous 23-year record. Water shortage and abundant rainfall in close repetition are harming the adaptive ability of the community, threatening not only the coping mechanism but also the developmental benefits (SAPCCHH). Within the span of 15-years, the scenario of drought is increasing and slowly starting to cover entire state, the exposure of people will lead to mal-nutrition, water scarcity, food price escalation, displacement, decrease in forest cover, low agriculture output and all of these will increase the vulnerability. Observations spanning 50-years (1951-2000) in the Central Indian region including Madhya Pradesh, indicates that extreme precipitation

events which are above 100 mm are increasing in terms of their intensity and frequency, with low and moderate events becoming more and more infrequent (Goswami et al. 2006).

Challenges to Agriculture in the context of Climate Change

Madhya Pradesh is predicted to get considerably more rainfall in the future than it does now, but with more violent storms and a generalized warming over the state, which would have significant ramifications for crop productivity and water resource management. According to Gosain and Rao (2016), the average annual rainfall is expected to rise by 11.6% by mid-century and by 30% by the end of the century. The majority of the increases occur during the monsoon season while more pre-monsoon rain is expected in the south of Madhya Pradesh for 2021–2050. The average surface daily maximum temperature in Madhya Pradesh in the 2030s is expected to rise by 1.8-2.0 °C, while the minimum temperature may climb by 2.0-2.4°C. The average maximum temperature is expected to climb by 3.4-4.4°C by the 2080s, with the northern area of the state rising the most. (MPSAPCC,2012). The Bundelkhand ecosystem is flat plateau with minimal slopes borders the Central India Plateau to the east and the Rewa-Panna Plateau to the northeast. This region's elevation spans from 150 to 450 meters and includes the districts of Tikamgarh, Chhattarpur, Datia, Gwalior, and Shivpuri. This area is made up of granite rocks with clay, clay loams and sandy loam soils. The region has Tropical semi-arid climate with low rainfall of around 700 mm annually. The proportion of waste lands is very high at about 37% in this sub-zone. Only about 45% of the land is cultivated; a little over a third of the cultivated area is irrigated. The Tikamgarh district belongs to Bundelkhand Agro-climatic zone involved in the NICRA-TDC programme and its agro-ecological description and the climate constraints are follows.

Bundelkhand Profile

Bundelkhand region comprising seven districts of Uttar Pradesh and six districts of Madhya Pradesh is one of the most backward regions of the country. Agriculture is the main source of livelihood of this region. It is a hard rock area with limited or inadequate ground water resources, lacks infrastructure and access to improved technologies. The region being largely rain fed is perturbed with variable precipitation trends. Drought conditions are frequent to the region. The continuous drought years has severely affected agriculture productivity and subsequently weakened the livelihood systems ('Bundelkhand Vikas Nidhi set up by the UP government in 1990-91 and the listing of MP Bundelkhand districts is derived from the scope of the MP Bundelkhand Development Authority created in April 2007). However, due to large area of waste land, the percentage of land used for cultivation falls drastically, to around 50%. Apart from size of cultivated land, agriculture production is primarily determined by availability of water. Irrigation supports multiple cultivation over a year, and offers considerable protection against vagaries of monsoon, the percentage of total irrigated land remains well below the state average, at around 42% of total sown land

(a) Climate Facts

(i) Temperature: The Bundelkhand region is marked by extremes of temperatures, reaching the mid to upper 40s centigrade during the summer months and dropping as low as 1 degree celsius in winter. During the summer season, high temperatures in the plain cause low pressure areas that induce movement of the monsoon. The temperature begins to rise in February and peaks in May-June. Hot breezes known locally as Loo are common during this period. It is a hot and semi-humid region. Minimum temperature varies from around 6-12°C. Maximum temperature varies from 38-40°C. Generally hottest days are in May and coldest days in December or January. The lowest temperature recorded is 0.60°C (www.bundelkhand.in)

(ii) Rainfall: The rainfall distribution pattern is irregular, with approximately 90% of all rainfall in the region caused by the monsoon, falling from June to October. Average rainfall per year is 800-900 mm but most is lost due to runoff. July and August are the months of maximum rainfall, while November and April are the driest months of the year. The scant winter rainfall is useful for the cultivation of 'rabi' crops, but it is usually inadequate without access to supplementary irrigation sources.

(iii) **Land:** Land use pattern in UP Bundelkhand and MP Bundelkhand districts is not significantly different from the rest of UP and MP, respectively. Net sown area in all MP Bundelkhand districts except Datia is considerably lower than in UP Bundelkhand. Around 7% of cultivable land in UP Bundelkhand and around 5% of cultivable land in MP Bundelkhand lies fallow in any year.

(iv) **Water:** Main rivers of Bundelkhand are Ken and Betwa, however, most rivers are dry or almost dry in summer. The lower courses of the rivers, towards the Yamuna, are in fertile alluvial plains, where the rivers cause much erosion and create ravines. Almost all the dams and reservoirs in Bundelkhand is built at the points where the upland meets the lowland; at these points, the rivers are narrow and the strata are hard. Quartz reefs in the courses of some rivers have led to formation of natural lakes and offer good sites for construction of dams.

(v) **Flora and Fauna:** Babul (*Acacia nilotica*), Khair (*Acacia catechu*), Palas (*Butea monosperma*), Ber (*Zizyphus*), Tendu (*Diospyros melanoxylon*), Mahua (*Madhuca indica*), Semal (*Salmalia malabarica*), Kardhai (*Anogeissus pendula*), Salai (*Boswellia serrata*), Seesham (*Dalbergia sissoo*), Dhau (*Anogeissus latifolia*), Karaundha (*Carissa spinarum*) shrub and occasionally, Teak, Tendu and bamboo are found in small patches across Bundelkhand's rivers, including animal species known locally as Rahu, Bhadur, Mrigal, Tingar, Singahi, Mangur, Awda, Baam, Sooja, Sinni and Mahasir. Size of operational (cultivated) land holdings is a basic factor affecting agricultural production, especially in absence of advanced cultivation technologies. Distribution of operational holdings in Bundelkhand the marginal holdings accounted for 40% of all holdings. The percentage of small (20%) and semi medium (15%) holdings of 1-2 hectares and 2-4 hectares. The percentage of medium (24%) holdings is 4 to 10 hectares. The large holding farmers more than 10 hectares are only 1%.

Climate Change Trend in Bundelkhand: Bundelkhand region has a long-standing history of droughts and famines. The region witnessed "The Panic Famine" of 1873-74 (Loveday, 1914). The Bundelkhand region of the state given its fragile geophysical condition is significantly sensitive to climate change. (Hedger and Vaideeswaran, 2010). Bundelkhand region by 0.28°C as compared to the baseline period of 1960-1990. Analysis of the simulated data generated by PRECIS Regional Climatic Model predicts that the temperature throughout the year is likely to be higher, in the range of 13.2 to 3.5°C by mid-century. The major precipitation season is expected to shift by one month (from July to August). The shift in the monsoon causes delay in sowing which in turn delays harvesting and in drier conditions the potential yields would be lesser. The climate science data developed by IITM revealed the climatic change exposure of Bundelkhand region 14 by the end of the century. The data was developed using the PRECIS model run over three time slices (2020s, 2050s and 2080s) using 1970s as base period. The study focused on two major indicators of climate change- rain fall and temperature in the region. The results from the model predicted variability in climate by the end of the century. The annual average surface temperatures are projected to rise by 1-2°C, up to 3°C and up to 5°C towards 2020s, 2050s and 2080s, respectively, especially in the northern part of Bundelkhand. Projected rise in lowest minimum temperature is more as compared to rise in maximum temperature. In near future there may not be such change in seasonal monsoon rainfall, however the rainfall may increase by 5-10% towards 2050s and up to 20% towards 2080s with respect to base. July rainfall is likely to decrease but other months show an increase in rainfall by the end of the century. The number of cyclonic disturbances may decrease in future but the systems may be more intense with increase in associated rainfall by 10-15 mm. Moreover, the number of rainy days may decrease, but may be more intense in the future. According to the report on drought mitigation strategies for UP and MP Bundelkhand by the Inter-ministerial Central Team, the region experienced a major drought in every 16 years during the 18th and 19th centuries, which increased by three times during the period 1968 to 1992 (Samra, 2008). Historically, the region was thickly forested but is now characterized by bare hilly terrain with sparse vegetation. Ironically, this once rich region has now become one of the poorest parts of the country. Except for Sagar and Jhansi districts, around 60% of main workers in Bundelkhand are engaged in agriculture as cultivators or labourers,

showing a higher reliance on agricultural land compared to other parts of rural India. Industrialization has been sporadic and this in turn has led to low levels of urbanization. Living conditions are harsh especially for the rural poor who depend mainly on agricultural incomes for sustenance, and are therefore highly vulnerable to drought and failure in cropping systems and loss of employment and incomes.

According to Tendulkar Committee Report 2009 estimates of poverty line and HDR 2004-05 with recurring drought and failure in agriculture, the level of poverty in rural areas have increased since a large number of farmers depend on rain fed agriculture. According to the inter-ministerial central team report (Samra, 2008), even though about 45% of net sown area in Bundelkhand is irrigated, the water supply is not adequate. The failure of the monsoon has severely affected the available water in river systems. The resulting diminishing water available in surface water sources as well as depletion of groundwater tables has not only decreased the availability of drinking water for people and domestic animals, but also impacted on the natural vegetation and growing grasses (crucial as fodder). Most tribal population inhabiting forests areas adjacent to rivers have no choice but to continue to exploit forests for survival and cause further over exploitation of resources. The repetitive crop failures and depletion of natural resources has led to widespread and increasing trends of migration to urban areas. With the collapse of monsoons and arrival of successive dry years, the inhabitants of Bundelkhand are now facing scarcity of water in almost every season. Urban areas are no better off than rural areas. The expense of securing water has been raised and the resource is treated as a commodity. Most urban municipalities supply water in the urban areas of Bundelkhand only twice or thrice a week. There were several manifestations of drought like, late arrival of rains, early withdrawal, long break in between, lack of sufficient water in reservoirs and drying up of wells leading to crop failure and even un-sowing of crops which

(b) Agriculture: Traditionally, gram and wheat were the main rabi (post-monsoon) crops in most parts of Bundelkhand and jowar and bajra were the main kharif (monsoon) crops. A variety of coarse cereals like finger millet (*Eleusine coracana*), kodon (*Paspalum scrobiculatum*), barnyard millet (*Echinochloa colona*), foxtail millet (*Setaria italica*) and little millet (*Panicum sumatrense*) was also grown in the Kharif season in some areas. Wheat was commonly grown in combination with chickpea. Pulses and wheat are the main crops across Bundelkhand, with wheat accounting for the highest area under cultivation in most districts. Large scale cultivation of wheat is a relatively recent occurrence, caused by increase in use of ground water irrigation and some increase in surface irrigation, supported by subsidies for water and power, as well as availability of high yielding varieties and assured procurement prices of the government. Chickpea has been traditionally grown in non-irrigated areas, cultivation of other pulses like lentil, peas, green gram and black gram has received a boost in recent times due to availability of short duration varieties. Maize is seen only in Lalitpur, and sorghum accounts for a significant area under cultivation only in Hamirpur, Banda and Chitrakoot. Barley and bajra have become minor crops and cultivation of coarse cereals is seen only in patches in hilly areas inhabited by tribal groups. Rice is cultivated only in Banda, Chitrakoot, Panna and Damoh. Cotton has virtually disappeared from the region due to paucity of assured water and sugarcane is grown only in parts of Datia, Jalaun and Tikamgarh districts.

Tikamgarh District of Bundelkhand (M.P.), India

Tikamgarh district is located between 24°26'10" to 25°33'15" N, latitude and 78°25'10" to 79°25'16" E longitude. It is bounded in the north and west by the Jhansi and Lalitpur of Uttar Pradesh, in east by the Chhatarpur district and separated by River Dhasan. The district is categorized into Central High lands (Malwa and Bundelkhand), Hot Sub-humid (Dry) Eco-sub region (10.3) Agro-Ecological Sub-Region (ICAR), Central Plateau and Hills Region (VIII) Agro-Climatic Zone (Planning Commission), Bundelkhand Zone (MP-8) Agro-Climatic Zone (NARP). The geographical area of the district is 5.04 lakh ha out of which cultivable area is 2.92 lakh ha, forest area is 0.68 lakh ha. The gross cropped area

of the district 3.01 lakh ha out of which 2.08 lakh ha is net sown area and 0.92 lakh ha area is sown more than once. The area under rainfed situation is 0.98 lakh ha and under irrigation is 1.45 lakh ha. The source of irrigation in the district are canals (0.06 lakh ha), tank (0.06 lakh ha), open wells (1.14 lakh ha), bore wells (0.09 lakh ha) and other sources (reservoir) (0.08 lakh ha). Rice, Wheat, chickpea, soybean and horticulture crops are the major crops grown in the district. Dairy, Goat and sheep farming is widely adopted. The average annual rainfall of the district is 1070.3 mm and much of the rainfall is received in Kharif. The pre-dominant soils in the district are black humus granitic & yellowish grey colour with Kankar soils. Wheat has the largest total cultivation area of 205,848 ha, with a significant irrigated area (205,173 ha) compared to rainfed (675 ha). Soybean follows with a total area of 22,873 ha, but only a small area (1,433 ha) is under irrigation. Rapeseed and Mustard, Sesamum, and Groundnut have total areas of 17,004 ha, 14,131 ha, and 10,908 ha, respectively.

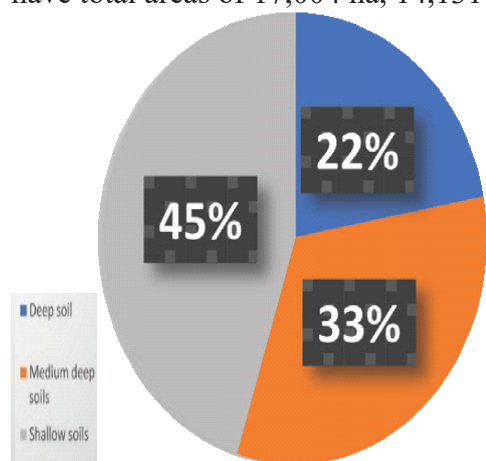


Fig.1: Land use pattern (lakh ha)

Fig.2: Season

wise distribution of rainfall (mm)

Fig. 3: Major Soils

Table 1: Area of major crops under rainfed and irrigated conditions in Tikamgarh, M.P., India

Crop	Rainfed area (ha)	Irrigated area (ha)	Total area (ha)
Wheat	675	205173	205848
Soyabean	21440	1433	22873
Rapeseed and Mustard	8483	8521	17004
Sesamum	13947	184	14131
Groundnut	6792	4116	10908

(A) Natural Resource Management Technologies

(i) Zero-tillage in wheat-black gram-cropping system in Bundelkhand

Zero-tillage has been one of the widely used resource conservation technology employed for saving precious resources which results in higher crop yield, lower production cost and saving in labour, water and energy. Timely sowing could be ensured through the zero-tillage. Happy seeder is a tractor-mounted machine that trims and enables wheat sowing in standing crop stubbles and farmers can sow wheat immediately after harvesting black gram without burning crop residue. Happy seeder uniformly places and presses the chopped crop straw in an inter-row area as mulch, which facilitates better germination, emergence, and vigorous initial crop establishment for better weed control and higher yield. Uniform distribution of crop straw left after the harvest can improve the nutrient status, wheat yield and improves organic content. Sowing of crop carried out with in-row spacing of 8 inches using tractor with double clutch of 45-55 HP at an optimum soil depth of 3.5-5 cm. Happy seeder can cover 5-6 acres/day, costing Rs. 2500-3000/ ha and it can be hired through custom hiring at a rate of Rs. 1500 /acre. A study was conducted during rabi season of 2020-21 with five farmers, with zero-tillage in wheat under wheat-soybean/black gram/sesame-cropping system in medium to light soil. The project for zero-tillage was in convergence with RLBCAU - KVKs participatory extension research project of

Bundelkhand in black gram-wheat cropping systems. The grain yield in zero-tillage was recorded as 2.94t/ha and it varied from 2.7-3.5t/ha. While in check plots the grain yield was higher with an average in 4.2t/ha which varied from 4.1to4.5t/ha. The gross return was found in zero-tillage Rs.63945/ ha and in conventional it was Rs.93090/ha. The higher net returns Rs.74656/ha in conventional tillage and less net return of Rs. 54610/ha obtained in zero-tillage. The results showed that grain yield and net return were higher in conventional method while the cost of cultivation was too higher in conventional tillage. But the average benefit cost ratio 5.8 was greater in zero-tillage than 4.0 conventional tillage practices. Zero tillage wheat requires lesser amount of critical inputs, which constitutes more than 40% of the total cost. Zero tillage reduced cost of cultivation by nearly Rs2,500-3,000/ha through reduction in cost of land preparation, and reduces diesel consumption by 50-60 l/ha. For further spread of the technology, proactive initiatives to provide the implement on hiring basis or from self-help groups which could be manage these at village or Panchayat level.

(ii) Broad bed and furrow (BBF) to minimize the impact of moisture stress and water logging

During the cropping season, crop often gets affected either due to dry spells or water logging in Tikamgarh district of Bundelkhand zone. BBF conserved rainwater in furrows, provided better drainage of excess water and proper aeration in the seed bed and root zone in deep black soils. BBF system involves preparation of a broad bed of 90 cm, furrow of 45cm and sowing of crop at a row spacing of 30cm. This technique reduced moisture stress during drought condition, increased water use efficiency, crop productivity, requires lower seed rate, saves water and time, enables better weed management and reduces crop lodging. As part of NICRA project, BBF method was demonstrated to 242 farmers in NICRA cluster of villages in Tikamgarh District. Data over 10-year period indicated that with BBF sowing, the crop could stand up to 20-days long dry spell as compared to 7-days in flatbed (farmer practice). Low seed rate was required in BBF sowing while 25% extra seed was needed in flat bed. Water use efficiency was increased by 41% in soybean and crop productivity was 33% more than flatbed sown crop. BBF sowing method also helped in reducing insect-pests, diseases and weeds. With BBF machine sown crop, better yield of 11.4 and 6.5 q/ha was reported in normal and stress condition compared to 7.3 and 4.6 q/ha under farmers' practice. Similarly, net return and cost benefit ratio was also high under BBF system in normal and stress conditions. Technology could be extended to other part of the district through development of custom hiring centers. The technology was spread in 32% (145 ha) of NICRA village and 736 ha in district.

Table 2: Economics of BBF planting in soybean at Tikamgarh, MP

Intervention	Crop Yield (q/ha)	Cost of Cultivation (Rs. /ha)	Gross Return (Rs. /ha)	Net Return (Rs. /ha)	B:C Ratio
Farmers' practice (flatbed) (normal year)	7.3	22700	29200	6500	1.2
Demo (BBF) (normal year)	11.4	25000	45600	20600	1.8
Farmers' practice (flatbed) (stress year)	4.6	16500	18400	1900	1.1
Demo BBF (stress year)	6.5	17300	26000	8700	1.5

(iii) Efficient use of harvested water through Sprinkler irrigation for wheat

Farmers practice flood irrigation method in Tikamgarh (M.P.). Hence, efficient water application technology, sprinkler irrigation was demonstrated which is suitable to all types of soil except heavy clay. It is most suitable for oil seeds, cereal and vegetable crops. It saves water, during intermittent or frequent irrigations, gives higher water application efficiency, provides mobility of system, can be used for undulated area, increases crop yield, improves micro-climate, possibility of using soluble fertilizers and chemicals and less problem of clogging of sprinkler nozzles. Sprinkler reduces the abiotic stress due to frequent and intense frosts and water droplets can reduce the stress on crops caused by sharp decrease in temperature. The sprinkler irrigation technology was demonstrated in wheat under NICRA

among 242 farmers of Kanti village in Tikamgarh (M.P.) during 2011 to 2021. The wheat yield was 12.9q/ha and 13.3q/ha higher under stress and normal year compared to farmers' practice. The money used for labour and other expenses got reduced by Rs 7418 /ha. The insect-pests reduced by 89.9% and weed biomass up to 78.9% in sprinkler irrigation. The average pooled data of 10-years in stress and normal year indicated that the sprinkler irrigation played a tremendous role in increasing the yield and getting more returns during stress and normal year in wheat with variety- GW322. In the 10-years of the NICRA project, the sprinkler technology was spreading 21% (127 ha) area of village and it could further upscaled through convergence of Horticulture and with PMKSY (Pradhan Mantri Krishi Sinchayee Yojana).

Table 3: Economics of sprinkler irrigation on wheat variety GW322 during stress and normal year (2011-2021)

Method of Irrigation	Crop Yield (q/ha)	Cost of Cultivation (Rs. /ha)	Gross Return (Rs. /ha)	Net Return (Rs. /ha)	B:C Ratio
Flood irrigation in wheat (stress year)	31.3	18600	61035	42435	3.2
Sprinkler irrigation in wheat (stress year)	44.2	22000	86190	64190	3.9
Flood irrigation in wheat (normal year)	32.3	21200	63792	42592	3.1
Sprinkler irrigation in wheat (normal year)	45.7	23800	90258	66458	3.7

(iv) Utilization of renewal energy through biogas plant

The climate vulnerability observed in Bundelkhand zone includes drought, scarcity of concentrated feed, green fodder and water for animals during drought. Proper utilization of livestock waste into biogas, compost and vermi-compost can increase crop yield and sustainability. Traditionally the dung cakes were utilized for cooking food in rural areas. From 1 ton of manure with 20 % solid content, 20–25m³ of biogas can be produced with a total energy value of 100–125kWh and the same can be utilized to generate 35–40kWh of electricity and 55–75kWh of heat energy. Biogas is an alternate source of energy for cooking and lighting in rural areas and manure is in the form of biogas slurry. Biogas plants were established in NICRA adopted village as per the availability of FYM due to large number of livestock population. The biogas plant was established in Kanti village of Tikamgarh district with the subsidy of Rs.13500/-from the Government department and IFFCO unit. The motivation and technological back stopping were carried out through KVK Tikamgarh under NICRA project. The biogas plants were established with convergence and farmer participation during 2011 to 2021. A total of 188-biogas plants were established among 160 families and cooking of food with biogas recorded reduction of eye and lungs diseases. Secondly, conservation of green forest is achieved through reduction of fire wood for cooking. The bio-gas slurry was used as a nutrient source for vegetable production. Before installation of biogas plants, all households used animal dung for domestic purpose as cakes whereas 36.67% of the households sold animal's dung as waste/fuel/manure, only 16.67% of villagers have adequate knowledge of biogas technology before installation of biogas plants. The plant provides 3 m³ biogas/day/plant i.e. a total of 4651 cubic meter. The biogas slurry was obtained @ 25kg/plant/day i.e. total of 4700 kg/day. The biogas slurry was used as fertilizer in vegetable production which boosted the production unto 25%. The advantages of biogas are increased nutrients & organic matter in soil (Rs 5000/ha/crop) and saved money for LPG by use of biogas (Rs. 1000/month), health improvement by reduction in women diseases (24.5%) and fire wood used for cooking reduced by 800kg/wood/day by 160 families and increased organic vegetable production (25%) and reduction in chemical fertilizers (25%). The technology can further up-scaled through convergence with the renewable energy department, watershed projects and by allied departments

(B) Crop Production Technologies

(i) Short duration and drought escaping varieties of soybean for Bundelkhand region

In Bundelkhand region, long duration (95-120 days) soybean varieties viz., JS 335, JS 9752 and JS 9305 are generally grown. Based on long term climate data, late monsoon, dry spell and early withdrawal of rainfall is common, resulting in low productivity affecting the timely sowing of succeeding rabi crop. As part of NICRA project, short duration variety JS 95-60 was demonstrated to address these concerns. In this region, early season drought (delayed onset), normal onset followed by 15-20 days dry spell, mid-season drought (long dry spell, consecutive 2 weeks without rain, terminal drought, insufficient ground water recharge due to low rainfall/over-exploitation, scarcity of feed and fodder and water for animals during drought, feeding/reproductive management of livestock during heat/cold wave are the real concerns. JS 9560 variety of soybean which is of 82-85 days duration is found excellent to overcome the climatic vulnerability which is suitable for specific situations like low rainfall, uplands and soybean/Black gram–wheat/mustard cropping system was introduced. It has the ability to escape terminal drought also. It is resistant to root rot and tolerant to insect pests and abiotic stresses. The experience gained from last 10 years of demonstrations under crop production module, it was started that the Soybean variety JS 9560 matures 15-18 days earlier than JS335 and others long duration varieties. In drought and low rainfall years, the JS9560 also tolerates about 10 days of dry spell occurred during cropping season in case of early withdrawal of monsoon at the time of September the performance of JS 9560 was superior to long duration varieties of soybean. Additional yield of 2-3 q/ha and additional income of Rs. 8595 /ha was obtained. JS9560 spread horizontally up to 60% area of the district after 2011 to 2021 as the variety is suitable for variable climate. Total 70 seed societies are producing 60% seed of JS9560. JS-95-60 has been widely adopted in about 40000 ha in Tikamgarh. The variety can be further spread as part of NFSM.

Table 4: Crop yield and economic performance of the variety

Intervention	Crop Yield (q/ha)	Cost of Cultivation (Rs. /ha)	Gross Return (Rs. /ha)	Net Return (Rs. /ha)	B:C Ratio
Farmers practice (JS335)-Stress year	4.6	16500	18400	1900	1.1
JS9560-Stress year	5.7	17300	22800	5500	1.6
Farmers practice (JS335)-Normal year	7.3	22700	29200	6500	1.2
JS9560- Normal year	10.8	25000	43200	18200	1.7

(ii) Short-duration stress-tolerant varieties of black gram for the Bundelkhand region

The climatic constraints are early season drought (delayed onset), normal onset followed by 15-20 days dry spell, mid-season drought, terminal drought, insufficient ground water recharge due to low rainfall/over-exploitation, scarcity of feed and fodder and water for animals during drought. Short duration, high-yielding stress-tolerant variety are needed so as to improve the resilience of farming in the drought prone areas. For this purposes, KVK, Tikamgarh under NICRA project introduced black gram variety IPU 94-1/PU-1 which can give an average yield of 12q/ha with 85 days duration. The results indicating from last 8 years of demonstration under crop production module that the black gram variety IPU 94-1 was tolerant against the mosaic virus, giving more yield about 2 q/ha than T-9. In the situation of early withdrawal monsoon at the time of September the performance of IPU 94-1 was superior to other long duration varieties of black gram. The other benefits of technology are as short duration, suitable during the late monsoon. The variety was better than local ones during both years, during the stress and normal rainfall. MYMV-resistant black gram varieties IPU-94-1/PU-1 have been widely adopted in about 35000 ha area in Tikamgarh, Madhya Pradesh as an outcome of the varietal performance in NICRA village. Tikamgarh become seed supplier hub of black gram varieties to other districts due to increased no. of seed societies. Black gram varieties popularized under NICRA from 2011 extended in district as 1.0 lakh and became a major crop

Table 5: Impact stress resistant varieties in Tikamgarh district, MP

Intervention	Crop Yield (q/ha)	Cost of Cultivation (Rs. /ha)	Gross Return (Rs. / ha)	Net Return (Rs. /ha)	B:C Ratio
Farmers' practice (T-9)-Stress year	1.5	16000	6000	-10000	-0.37
PU-1-Stress year	2.4	19300	22800	3500	1.2
Farmers practice (T-9)-Normal year	4.1	20700	24600	1900	1.1
PU-1- Normal year	5.4	25400	32400	7000	1.2

(iii) Short duration stress tolerant varieties of chickpea for Bundelkhand region

The climatic vulnerability was early season drought (delayed onset), normal onset followed by 15-20 days dry spell, mid-season drought (long dry spell, consecutive 2 weeks rainless, terminal drought, insufficient ground water recharge due to low rainfall/over-exploitation, scarcity of feed and fodder and water for animals during drought, feeding and reproductive management of livestock during heat/ cold wave. Improved, short-duration, high-yielding wilt-tolerant Chickpea variety JG-16 along with proper management practices was introduced to impart resilience. The chickpea variety JG-16 have the characteristics like maturity: 110-115 days, seed size: 22-25 g, seed yield: 18-20 q/ha, semi spreading, profuse branching, dark green foliage, light brown, medium bold, attractive seed, suitable for rainfed and tolerant to wilt. JG-16 was giving more yield about 2.1q/ha, than Khajuwaha. The variety was found tolerate dry spells occurred during the cropping season while in the situation of early withdrawal monsoon at the time of September the performance of JG-16 was superior to other long-duration varieties of chickpea. The RVG-201 variety was demonstrated to 150- farmers at Kanti village of NICRA, District- Tikamgarh (M.P.). The results showed that on an average 3.4q/ha additional yield was obtained during stress years by variety RVG-201 and an additional return of Rs.11700 (Rs/ha) was obtained. The RVG-201 also performed better during normal years as well as in stress years. Biotic stress resistant and tolerant varieties of chickpea JG-16/RVG-201 were widely adopted in Tikamgarh (M.P.) as an outcome of the varietal demonstration in NICRA village. Chick pea varieties popularized under NICRA is adopted in an area of 3500 ha. The variety can be further spread by NFSM.

Table 6: Performance of stress tolerant varieties of chickpea in Bundelkhand region of MP

Intervention	Condition	Crop Yield (q/ha)	Cost of Cultivation (Rs. /ha)	Gross Return (Rs. /ha)	Net Return (Rs. /ha)	B:C Ratio
FP(JG-74)	Normal year	12.5	18600	63750	45150	2.4
RVG-201		17.3	20500	88230	67730	3.3
FP(JG-74)	Stress year	11.7	16600	46800	30200	2.8
RVG-201		15.1	18500	60400	41900	3.2

(iv) Drought-tolerant high high-yielding varieties of sesame for risk minimisation

Farmers of Bundelkhand have been growing sesame since past many decades in their history. The sesame has been a risk minimizing crop during kharif season because it could be grown in limited rainfall and sometimes it is used as optional contingent crop when no other crops can be sown timely. When farmers could not sow either black gram, soybean or groundnut by July 20, sesame is the only option for reasonable returns. Sesame variety, TKG 308 can tolerate moisture stress, moderately resistant to *Macrophomia*, *Cercospora*, bacteria leaf spot, leaf curl, tolerant to capsule borer, oil content of 48-50%, and average yield 7-7.5 q/ha. The variety was found to save water, optional crop during late monsoon and low rainfall condition and for providing reasonable income to farmers. The sesame variety TKG 308 was demonstrated to 242 farmers in NICRA village- Kanti, Tikamgarh district. The sesame variety TKG-308 took 85 days for maturing while the local/old sesame varieties were matured at 80 days. During the drought and low rainfall years, the variety TKG-308 was also found tolerant to 10 days of dry spell occurred during cropping season while in the situation of early withdrawal monsoon at the time of September the performance of TKG-308 was superior to local varieties of sesame. The reductions in biotic stress (insect & diseases) were also reducing up to 95%. The extra yield was 2.3

q/ha and additional income of Rs. 14340/ha were obtained. The results showed that on an average TKG-308 produce 0.34 q/ha higher yield during stress years (41.46% more) than farmers' practices. TKG-308 performed better during normal years as well as in stress years in which yield was more (2.10 q/ha) and higher returns were realized compared to farmer's practices. The sesame variety TKG 308 was found suitable during late monsoon and low rainfall conditions as contingent plan. This variety is widely adopted in Sesame growing area about 11000 ha in Tikamgarh Madhya Pradesh.

Table 7: Impact of drought tolerant sesame variety TKG 308 at Tikamgarh, MP

Intervention	Condition	Crop Yield (q/ha)	Cost of Cultivation (Rs. /ha)	Gross Return (Rs. /ha)	Net Return (Rs. /ha)	B:C Ratio
Farmers practice (Till)	Normal	3.4	6000	27200	21200	4.53
TKG-308		5.5	8000	44000	36000	5.50
Farmers practice (Till)	Stress	0.82	6000	6560	560	1.09
TKG-308		1.16	8000	9280	1280	1.18

(v) Mustard varieties suitable for low water availability

Mustard has been a risk managing crop during Rabi as it could be grown with limited irrigation water availability. The soils of Tikamgarh District 70% of light and medium soil which are suitable for mustard cultivation. Mustard varieties – Pusa Jagannath, Pusa Bold, Pusa Tarak and Giriraj can give maximum yield with limited irrigation in light and medium soil over the farmers' varieties. The mustard varieties– Pusa Jagannath, Pusa Bold, Pusa Tarak and Giriraj were demonstrated among 242-farmers at NICRA villages of Tikamgarh. The yield of mustard varieties on an average 3.1 q/ha more than the yield of farmers old/local varieties, thus this extra yield was provided extra saving of 9997Rs/ha to the farmers when they were growing high yielding mustard varieties instead of their local and old varieties in the limited irrigation water availability on light and medium soil. The data from table indicate that on an average 4.1 q/ha higher yield was realized during stress years in limited irrigation on light and medium soils with varieties, Pusa Bold/Giriraj that was 49.39% more yield than farmers varieties. Pusa Bold / Giriraj were also performed better during normal years as well as in stress years in which yield was more extra about 4.9(q/ha.) and maximum return with extra in 18485 (Rs/ha) than farmers practices. These varieties were widely adopted in Tikamgarh (M.P.) as an outcome of the varietal performance in NICRA village which can be included in the seed supply chain for making them available.

Table 8: Performance of mustard varieties with limited water at Tikamgarh, MP

Intervention	Condition	Crop Yield (q/ha)	Cost of Cultivation (Rs. /ha)	Gross Return (Rs. /ha)	Net Return (Rs. /ha)	B:C Ratio
Farmers practice (T-9)	Normal year	10.3	16500	47895	31395	2.90
Pusa Bold/Giriraj		15.2	20800	70680	49880	3.39
Farmers practice (T-9)	Stress year	8.3	14500	31540	17040	2.10
Pusa Bold/Giriraj		12.4	16500	47120	30620	2.85

(vi) Introduction of high value crop Safed Musali (*Chlorophytum borivilium*) variety RC-1in light and medium soils conditions

Low value crops were growing during rainy season like soybean, black gram and sesame which give less return/ha in light and medium soils conditions. Safed Musali (*Chlorophytum borivilium*) is suitable for hot and sub-tropical climatic conditions which are prevalent in Bundelkhand region. Safed Musali was a tuber crop which could be grown like onion, potato and garlic, that why the crop was suitable for medium & low light soils due to underground tuber development facilitated by light and medium soil, can tolerate moisture stress during crop growth and development and generally grown under rainfed. The soil of the district about 75% belong to medium and light soil which facilitate the tuber formation, water availability during rainy season is sufficient to cultivation of Safed Musali. The demonstrations to promotion the cultivation of high value crop were made for two years (2017-18 to 2018-19) under NICRA project at NICRA adoptive village Kanti, district, Tikamgarh with 55 farmers. Safed Musli was matured at 125 days and net return was 51% higher than the crops like soybean

and black-gram which were grown during kharif season in the same climatic situation. The above table indicates that the cultivation of Safed Musali on the same climatic conditions of the major kharif crops like soybean, black gram and sesame has given 50 q/acre fresh tuber yield which after drying become 12q/acre. This dried value of Safed Musali is much higher than normal kharif crops grown in the region. The Safed Musali is growing in NICRA village – Kanti and farmers are getting high return instead of soybean, black gram and sesame cultivation. Now the farmers of villages are adopting growing of Safed Musali in about 150 to 200 ha in the Tikamgarh district.

Table 8: Economic impact of High value crop Safed Musali variety RC-1.

Crop	Variety	Fresh Tuber Yield (q/acre)	Dried Musali Yield (q/acre)	Gross Cost (Rs. /acre)	Gross Returns (Rs. /acre)	Net Returns (Rs. /acre)	B:C Ratio
Safed Musali	RC-1	50	12	315000	1200000	885000	3.81

(C) Live Stock Production Technologies

(i) Breed up gradation with Murrah buffaloes for resilience for Bundelkhand region

Breed up gradation was taken by KVK, Tikamgarh under NICRA Project in convergence with the veterinary department. Three male Murrah buffaloes were introduced in the NICRA villages for breed upgradation of local buffaloes and 25 adjacent villages were covered in a span of 10-years. Murrah breed of buffalo is well adapted to Bundelkhand region where higher ambient temperatures, lower quality diets and greater disease occurrence is commonly observed. It is one of the recommended breeds of buffalo under state livestock breeding policy. Murrah buffaloes were giving more milk (7.5 l/day), as compared to local (4.5 l/day). The Murrah calves were sold by farmers @Rs.5000 each. Over a period of 10-years, a total of 590 buffaloes were served in 35 villages and a total of 557 calves were born which had higher milk producing potential and better adaptability. Net returns (Rs/day/animal) and B:C ratio was also higher with Murrah breed over local breed. Breed up-gradation with Murrah breed in the district can be taken up in convergence with Veterinary department/NGOs.

Table 9: Impact of Murrah buffalo bull promotion over local breed in NICRA village

Interventions	Milk Production (l/day/animal)	Gross Cost (Rs/ani)	Gross Return (Rs/ani)	Net Return (Rs/animal)	B:C Ratio
Murrah	7.5	1000	5000	4000	5.0
Non-descript	4.5	500	3000	2500	1.2

(ii) Breed up gradation using Jamunapari goats for resilience in Bundelkhand region

Breed upgradation using Jamunapari buck was taken up by KVK, Tikamgarh under NICRA Project in convergence with veterinary department and NGOs. Each year 10-bucks were provided to the 10-goat farming farmers. Jamunapari breed has the capacity to adopt to higher ambient temperatures, lower quality diets and greater disease challenge and efficient converter of feed into meat under climatic conditions of Bundelkhand region. Jamunapari goats are considered one of India's best dairy breeds well suited to hot, dry climates and can be kept on various pasture types. It is one of the recommended breeds of buffalo under state livestock breeding policy. Jamunapari goats could achieve better body weight (31.9%) in one year as compared to the non-descript goats with an improvement of 200% in milk yield. Kids were sold by farmers @ Rs. 3000 each. Over a period of 10-years, a total of 45 bucks were provided to the farmers in 3-villages and a total of 90 kids were born out of this. Breed up-gradation through Jamunapari can be taken up in the district in convergence with veterinary Department/NGOs

Table 10: Impact of Jamunapari buck over local breed in NICRA village

Breed	Body Weight (kg/year/buck)	Milk Yield (lit/goat)	Money Saving (Rs. /buck)
Local breed	18	0.5	8,000
Jamunapari	32	1.5	15,500

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Sustainable Development through Green Chemistry**S. Ravichandran***Chemistry, St. Peter's Institute of Higher Education and Research, Chennai, Tamilnadu, India.***ABSTRACT**

Green chemistry represents the pillars that hold up our sustainable future. Many industries and research of many academics recognize the significance of green chemistry. In the practice of green chemistry, a set of principles that reduces or eliminates the use of hazardous substance in the design, manufacture and applications of chemical products are utilized. Chemistry is really very helpful to us as its applications are used worldwide for several purposes. We cannot really imagine a world without chemistry and its applications. However, we should now concentrate on green chemistry, or sustainable chemistry, which refers to reducing or stopping the damage done to the environment around us. Hence, green chemistry could include anything from reducing waste to even disposing of waste in the correct manner. Chemical derivatives must be avoided as far as possible in any type of application as they often prove to be harmful. All chemical wastes should be disposed off in the best possible manner without causing any damage to the environment and living beings. Green chemistry and sustainability essentially go hand in hand. Sustainable development is meeting the needs of the present generation without compromising the ability of future generations to meet their own needs. We need greener chemistry-chemistry that efficiently use renewable raw materials, eliminates waste and avoids the use of toxic and or hazardous solvents and reagents in order to achieve this noble goal. Green chemistry is one of the most fundamental and powerful tools to use on the path to sustainability. In fact, without green chemistry and green engineering, there is no path to sustainability.

Ecomorphological Differentiation of Deep-Sea Scorpaenoid and Dactylopterid Fishes from The Arabian Sea, Northern Indian Ocean: Insights into Ecological Strategies and Habitat Use**Davood Nihal^{1,2}, Aneesh Kumar K.V.³, Purbali Saha¹, Emilla John⁴, Hashim Manjebrayakath¹**¹*Centre for Marine Living Resources and Ecology (CMLRE), Ministry of Earth Sciences (MoES), Govt of India, Kochi, Kerala, India.*²*Department of Marine Biology, Microbiology and Biochemistry, School of Marine Sciences, Cochin University of Science & Technology (CUSAT), Cochin, Kerala, India.*³*Department of Aquaculture, Sacred Heart College (Autonomous), Cochin, Kerala, India.*⁴*Department of Zoology, Union Christian College Aluva, Cochin, Kerala, India.***Purpose**

Understanding fish assemblages using ecological frameworks is crucial for evaluating the health and functioning of marine ecosystems amid climate change (Pinna et al., 2023). Trait-based approaches, which focus on the functional roles of species, offer deeper ecological insights and can detect subtle changes that are often overlooked by traditional taxonomic methods (Villéger et al., 2017). Additionally, sagittal otoliths exhibit pronounced interspecific morphological variation that corresponds with ecological roles and feeding strategies, while enhancing both acoustic and balance functions in deep-sea environments. These approaches are particularly valuable for understanding how fish form relates to function, especially in cases where direct ecological observations are limited or impractical.

With the increasing impacts of climate change, human activities, and resource exploitation, there is growing interest in how deep-sea fish communities respond, adapt, and coexist. In this context, 'ecomorphology' a functional trait-based approach that links morphological characteristics to ecological roles has emerged as a powerful tool. While numerous studies have explored functional diversity in pelagic and reef fishes, information on deep-sea species, particularly from Indian waters, remains limited (Kumar et al., 2017). This study aims to enhance our understanding of ecomorphological

differentiation among major deep-sea scorpaenoid and dactylopterid species from the Arabian Sea and the northern Indian Ocean.

Materials and Methods

Fish specimens were collected as bycatch from deep-sea shrimp trawlers operating at depths of 200 to 420 meters in the southeastern Arabian Sea between January 2022 and December 2023. Right sagittal otoliths were extracted following standard protocols. Otolith size relative to fish body size was analyzed as an indicator of habitat use and depth distribution. Sixteen morphological traits were measured from the fish body and standardized to remove size-related (allometric) effects, since functional traits were found to correlate with total fish weight. Based on these measurements, 12 ecomorphological attributes were identified, reflecting the mode of food acquisition, position in the water column, swimming behavior, and preferred food type (Farré, et al., 2016; Kumar et al., 2017). Principal component analysis (PCA) was used to identify ecomorphological variation among species. (Nishimoto et al., 2010). Data normality and variance homogeneity were tested using Shapiro-Wilk and Levene's tests, respectively. As the data were non-normal but homoscedastic, non-parametric tests such as one-way PERMANOVA and Kruskal-Wallis tests were employed confirming our hypothesis of significant inter-specific differences (Dinno, 2015). To test for significant differences inter-specific functional traits, a PERMANOVA was performed, followed by Bonferroni-corrected pairwise comparisons. Random Forest analysis (Breiman, 2001) based on retained PCA scores was conducted to assess species classification accuracy, using leave-one-out cross-validation (Nishimoto et al., 2010). All statistical analyses were conducted using PAST (version 1.81) (Hammer et al., 2001) and R software.

Results

The first twelve PCA axes explained 99.9% of the total variance, with the first three contributing 69.2%. PC1 accounted for 42.6% of the variance, with positive scores associated with higher values of ArPF, Edst, FSr, and FSb, and negative scores with higher Ops, Bsh, and Osf. PC2 explained 15.74% of the variance, with positive scores related to higher Ops, ArCF, FSb, FSr and negative scores linked to Osf and Bsh. Otolith morphometric analysis also revealed species-specific variations in sensory traits in otolith relative size variables.

Conclusions

This study is the first to examine how functional traits reflect ecological adaptations in dominant deep-sea scorpaenoid and dactylopterid fishes from Indian waters. The findings reveal clear interspecific differences in traits related to swimming and feeding, highlighting the ecological diversity within these groups. In the resource-limited deep-sea environment, such differences likely reduce competition and promote species coexistence through resource partitioning. Morphological traits, including otolith relative size, were found to influence feeding habits, foraging strategies, sensory capabilities, and locomotion, factors that collectively define the ecological roles of these fishes. The high classification accuracy based on morphometric traits further supports the effectiveness of the ecomorphological approach.

However, since these fish groups are dominant in trawl bycatch, their selective removal poses serious ecological risks. Species with extreme morphologies often perform unique functions that cannot be replaced by others, making their loss particularly concerning. Overall, these findings provide valuable insights into the functional roles and spatial distribution of deep-sea fishes and can inform sustainable fishery management strategies. Nonetheless, further research involving a broader range of species, along with detailed dietary and habitat data and assessments of niche overlap, is essential to better understand these complex ecological interactions.

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Unveiling tree diversity: a floristic insight into agroforestry practices of Chhattisgarh's Plains

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ABSTRACT

A comprehensive study carried out between 2021 and 2023 explored the composition and diversity of woody perennial tree species across various agroforestry systems within the Chhattisgarh Plain Agro-Climatic Zone (ACZ) of Madhya Pradesh, India. Soil assessments across the systems revealed marked differences, with Home Gardens (HG) standing out for their superior soil health showcasing the lowest bulk density (1.23 Mg m^{-3}), and the highest levels of organic carbon (6.93 g kg^{-1}), available nitrogen (354 kg ha^{-1}), potassium (273 kg ha^{-1}), and moisture content (22.90%). Conversely, the Agri-silviculture (AS) system recorded the highest soil compaction and comparatively poorer nutrient status.

Floristically, the survey catalogued 81 species representing 65 genera and 35 families, with Home Gardens again leading in species richness 32 species identified at Site 1 and 26 at Site 2 followed by Agri-horticulture (AHS) and Agri-silviculture (ASP) systems. Biodiversity metrics, notably the Shannon-Weiner diversity index, peaked in HG ($H' = 2.95$ at Site 1), indicating a richer and more even species distribution.

Statistical correlations revealed that tree species diversity was negatively associated with bulk density but positively correlated with organic carbon and key available nutrients. Multivariate analyses offered deeper insights: Detrended Correspondence Analysis (DCA) uncovered clear clustering patterns driven by land-use practices, while Canonical Correspondence Analysis (CCA) underscored the joint influence of socio-economic dynamics and edaphic factors in shaping species assemblages. This study underscores the ecological and socio-economic relevance of agroforestry systems in fostering biodiversity and improving soil health in central India.

Keywords: *Agroforestry systems; Chhattisgarhi Plain ACZ; evenness index; floristic composition; H' index; ordination; soil properties; species richness*

Pantoea spp. was Found to be Associated with Citrus Canker in the Northern Region of West Bengal

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Purpose

The worldwide production of citrus is threatened by a number of biotic and abiotic factors. Although lemon orchards are kept in great esteem yet its present status is threatened by a number of problems, in which citrus canker is considered to be the first cause in the large queue of bacterial diseases of citrus trees. Five forms of the citrus canker have been documented as, cankers “A”, “B”, “C”, “D”, and “E” based upon host range, level of aggressiveness and geographical origin. Thus, the analysis of molecular variability aids in our understanding of their virulence and origin. It is difficult to control the pathogen without knowing the characteristics and origin of the isolates. There are some references about the citrus canker strains, which were found in India but in case of West Bengal, mostly in its northern part it is very limited. Also, the prevailing strains of citrus canker from lemon plants from northern part of the State has not been studied till date. Different studies revealed the possibilities of evolving bacterial canker associated pathogen. Hence keeping in mind, the present study was planned.

Material and Methods

The symptomatic samples of citrus canker were collected from different districts of northern part West Bengal. The different plant parts like infected leaves, twigs and fruits were used for isolation of pathogen by crushing canker tissue in sterile water, streaking the macerate on nutrient agar (NA) plates and petri plates were incubated at 27°C for 48 hours. The typical bacterial colonies showing characteristics of citrus canker pathogen were maintained on the slant containing Nutrient Agar (NA) medium and subsequently sub cultured at regular intervals. Slants having purified cultures were preserved in refrigerator for further use. For molecular characterization and diversity analysis at first extraction of total genomic DNA was performed using a DNA isolation kit. After that polymerase chain reaction (PCR) was performed from using a 16s rRNA gene specific primers - 27F (AGAGTTTGATCMTGGCTCAG) and 1492R (TACGGYTACCTTGTTACGACTT) as forward and reverse primer respectively. After PCR amplification sequencing was done and BLAST_n from NCBI and other bioinformatics tools were applied to analyze all sequence data. For screening out the most virulent isolate, bacterial isolates were revived from -40°C and the concentration were maintained 10⁶ CFU/ml in nutrient broth. These isolates were inoculated using injection method on leaves of an individual plant. Here one susceptible variety of lemon was used for this study. We got virulence order of these strains from disease scoring technique by using the disease scoring scale by post inoculation development of bacterial lesions at 20 days. Disease were assessed by calculating the percent disease incidence by given formula –

Results

The result showed that Five among the isolates were found to be virulent in first year as well as second year. Further they were used for characterization and observation of molecular diversity among them. Five virulent strains were proved to be *Pantoea* spp. by molecular characterization, which are associated to cause canker disease. Among these five virulent strains one most virulent strains (showing disease

increase percentage of 59.390% in first year and 48.883% in second year) were identified in this local climatic condition, which can be helpful to identify the resistant local varieties, which can be used by the farmer in future.

Conclusions

Citrus canker is most prevalent disease of citrus in local condition and it reduces the yield and income of the citrus farmers. Therefore, the present experiment was carried out to find the molecular diversity among the isolates of citrus canker pathogen of North Bengal and to find the most virulent isolate in the local environmental condition. Identified most virulent isolate from our study can be helpful to identify the resistant local varieties, which can be used by the farmer in future.

Keywords: *Citrus Canker; Virulent; Strains; Molecular Characterization; Pantoea spp.; Resistant*

Effects Of Tree Age And Cutting Position On Clonal Propagation Of *Melia Dubia* Through Shoot Cuttings

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EXTENDED SUMMARY

Purpose

Melia dubia (Malabar neem) is a fast-growing, multipurpose tree species widely recognized for its industrial and ecological significance. It has emerged as a highly compatible agroforestry species due to its morphological, physiological, and functional traits, including negligible allelopathic effects on associated understory crops. Its short rotation, high biomass yield, and adaptability make it a preferred species in agroforestry and commercial plantations. However, natural regeneration through seeds is unreliable due to genetic segregation and poor seed viability, posing a challenge for maintaining uniform planting stock. In this context, the present study was conducted to identify the most suitable tree age and branch position for the vegetative propagation of *Melia dubia* using shoot cuttings, with the aim of enhancing the availability of genetically superior and uniform planting material for agroforestry and timber-based plantations.

Material and Method

Superior phenotypes of *Melia dubia* of four different age classes (1, 2, 3, and 4 years) were randomly selected, and 12 cm long shoot cuttings were prepared. Based on the branch position, cuttings were categorized as apical, middle, and basal. A total of 720 cuttings (20 per replication) were used in a randomized design. Weekly observations were made for sprouting. Rooting data were recorded 60 days after planting in a mist chamber, including parameters such as rooting percentage, number of roots, and root length. A cutting was classified as rooted if it developed at least one root >1 cm in length. Rooted cuttings were transferred to a shade house for 30 days of hardening and then transplanted to the field. Percent survival was recorded 30 days after field planting. Statistical analysis was performed using SPSS software.

Results

The results revealed significant variation in rooting and survival based on tree age and branch position. Cuttings from two-year-old trees showed the highest rooting percentage (69.44%), while the middle branch position exhibited the best rooting success (69.16%) compared to apical and basal portions. A significant effect ($p \leq 0.05$) of age was observed in the survival of cuttings. Highest survival was observed in cuttings made from three (68.89%) and two year old (68.88%) plants. Shoot cuttings obtained from middle branch position showed maximum survival irrespective of the plant age. These combinations also recorded better sprouting and post-transplant survival, highlighting their suitability for clonal propagation. The findings suggest that selecting cuttings from two-year-old trees and the

middle portion of branches ensures maximum propagation success and the production of high-quality planting stock.

Conclusions

The study demonstrates that clonal propagation of *Melia dubia* through shoot cuttings is significantly influenced by the age of the donor plant and the position of the cutting on the branch. Two-year-old trees and middle branch segments are ideal for achieving high rooting and survival rates. This method supports the large-scale multiplication of genetically superior individuals, contributing to sustainable agroforestry and timber production systems.

Keywords: *Melia dubia*; shoot cutting; rooting percentage; clonal propagation; agroforestry; vegetative propagation, survival rate

Textural attributes of different formulations of Sapota Pulp and Millet based Fruit Loop Breakfast Cereals

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ABSTRACT

Seven formulations (T0–T6) of sapota-millet-based fruit loops were developed by varying the proportions of flours and sapota pulp. T0 served as the control, containing 25% each of wheat, corn, and oats flours with jaggery, excluding millet flour and sapota pulp. T1 included wheat, corn, oats flours, sapota pulp, and jaggery (20% each), while T2 contained the same flours and sapota pulp (25% each) without jaggery. T3 and T4 used ragi instead of wheat, with T3 including jaggery (20% each) and T4 is excluding it (25% each). T5 and T6 incorporated jowar similarly, with jaggery only in T5. Texture analysis was performed using a TA.XT Plus texture analyzer with a TA44 Probe. Hardness values (mean $\pm$ SD, n = 3) revealed significant differences ($P < 0.05$) among formulations. T1 ($7835 \pm 22.00a$), T3 ($7725 \pm 21.00a$), and T6 ($7775 \pm 12.00a$) recorded the highest hardness, grouped statistically together and indicating greater crispness. T0 ($3010 \pm 24.00e$) was the softest. T4, T5, and T2 showed intermediate hardness levels, with T4 firmer than T2 and T5, but softer than T1, T3, and T6. The results suggest that the type of millet and presence of jaggery influence the textural quality of the product. T1, T3, and T6 may be preferred for their crisp texture, aligning with consumer expectations for loop-type snacks. These findings highlight the role of formulation in determining product quality and potential shelf-life.

Keywords: *Sapota*; *ragi flour*; *wheat*; *jowar*; *texture profile analysis*

Value Addition in Green Chilli Sauce through Preservation Methods

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Krishi Vigyan Kendra (CIAH-ICAR), Panchmahal, Gujarat, India.

ABSTRACT

In rural areas of Panchmahal district, farm women often prepare green chilli chutney using traditional methods. However, this chutney has a very limited shelf life, typically lasting only 2–3 days at room temperature and about 6 days under refrigeration, primarily due to lack of awareness about proper food preservation techniques. To address this, an On-Farm Testing (OFT) was conducted in 2024–25 under the thematic area of Food Preservation, aiming to increase the shelf life of green chilli sauce using scientifically recommended preservation methods as per FSSAI standards. The objective was to compare the traditional method (TO1), which used green chilli, salt, and garlic, with an improved

method (TO2) that included green chilli (1 kg), water (250 ml), salt (30 g), potassium metabisulphite (1 g/kg), asafoetida (1 g/kg), and glacial acetic acid (30 ml). A total of 12 trials were conducted with the active participation and regular monitoring by farm women. The results showed that TO2 extended the shelf life significantly up to 15 days at room temperature and 140 days under refrigeration, demonstrating a fivefold improvement. Sensory evaluation also favored TO2, with improved scores for colour (4.0 vs. 4.2), texture (4.3 vs. 4.1), taste (4.2 vs. 4.5), flavour/aroma (4.1 vs. 4.3), and overall acceptability (4.1 vs. 4.4). The economic cost of TO1 was ₹120/kg, while TO2 cost ₹131/kg, with the ₹11 increase due to preservatives like KMS (₹5) and glacial acetic acid (₹6). Farm women appreciated TO2 for its longer shelf life, enhanced taste, and income-generating potential. This assessment clearly demonstrates that simple, low-cost preservation techniques can convert perishable produce into durable, marketable products-empowering rural women through food security, entrepreneurship, and reduced post-harvest losses.

Keywords: Food preservation; Value addition; Shelf life; Food security; Income generation

Effect of EMS mutation to improve the heat stress tolerant ability of Rice cultivars of N22

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ABSTRACT

Heat is one of the major factors that considerably limit rice production. Nagina 22 (N22) is a deep-rooted, drought and heat-tolerant rice cultivar known for its ability to withstand heat and drought. has been extensively utilized in genomic studies to identify and characterize rice genes linked to tolerance against various abiotic stresses. In this particular study, we conducted screenings on N22 mutants induced by EMS to determine their enhanced tolerance to high temperature (HT) stress during both the seedling and reproductive stages. Four heat tolerant N22 mutants (NH363, NH663, NH733, and NH669) exhibited superior grain yield and spikelet fertility than N22 under HT Stress, Notably, NH733 displayed superior pollen fertility, stigma receptivity, spikelet fertility, photosynthetic rate, SPAD value, shoot length, root length, total dry weight, and antioxidant activity compared to N22 under high HT Stress conditions. We performed whole-genome RNA sequencing of NH733 revealed the commonly induced genes under three stress environments as well as the exclusive genes associated with specific stress. These results will be taken together; the mutant NH733 might serve as a valuable genetic resource for the discovery of novel genes associated with heat stress tolerance in rice.

Keywords: *Oryza sativa*; Abiotic stress; EMS mutagenesis; Nagina22; Yield

Importance of Biotechnology tools on Potato (*Solanum tuberosum*) crop improvement

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ABSTRACT

The potato (*Solanum tuberosum* L.) is a major world food crop that originated in America. It gives an exceptionally high yield and also produces more edible energy and protein per unit area and time than many other crops. Conventional potato breeding as it is practiced worldwide is an inefficient, slow process that has changed little in the past century. Potato breeding efforts have historically focused on yield, fresh market and processing quality, and storability as well as disease resistance.. Potato is an

ideal crop for the introduction of traits using biotechnology.. The creation of genetic mapping and the use of molecular markers and other genomics in potato breeding have both been hindered by many genetic traits. Different molecular techniques are described for genotype-phenotype associations, candidate genes, describing loci, and alleles in potato. Consequently, future potato breeding initiatives should prioritize bolstering resistance to both stresses (abiotic & biotic), capitalizing on the rich diversity of genetic resources conserved in various gene banks. Molecular techniques, such as marker-assisted selection, genome-wide association studies, functional genomics and transgenics, offer potent tools for advancing potato breeding programs. The availability of tissue culture technology for rapid multiplication of disease free planting material has facilitated potato seed production to a great extent. Genetic engineering and genome editing also hold promise for creating novel potato varieties. To ensure the production of disease-free potato seeds, the integration of tissue culture methods into plant breeding becomes imperative. With its storied history as a dietary staple for millions and a promising future, the potato's demand is projected to surge, catalyzing intensified research efforts.

Keywords: *Breeding; Genome editing; Germplasm diversity and Tissue culture*

Impact of Land Use and Soil Depth on Soil Quality Index in Madhubani Block, Bihar

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ABSTRACT

This study assessed the Soil Quality Index (SQI) in Madhubani Block, Bihar, under various land use systems and soil depths in order to determine how land use affects soil health. Samples of soil were collected at three distinct depths: 0–20 cm, 20–40 cm, and 40–60 cm from four essential land use systems: rice–wheat, mango orchard, vegetable-vegetable, and guava orchard. pH, electrical conductivity (EC), organic carbon (OC), available nitrogen (N), phosphorus (P), potassium (K), and bulk density were among the significant soil factors that were studied. Weighted scoring, the normalization process, and a minimum data set (MDS) approach were used to determine the SQI. According to the results, the Vegetable-Vegetable system at 0–20 cm had the highest SQI (0.76), which was explained by a greater quantity of nutrients and organic carbon carried on by intense input utilization. At the surface layer, the Rice–Wheat system showed a moderate SQI (0.61), which significantly decreased as depth increased. While the SQI values of mango and guava plantations were relatively stable over depths, they were distinguished by reduced OC and available N, particularly below 20 cm. Under the Guava Orchard, the lowest SQI (0.43) was noted at 40–60 cm. In conclusion, both soil depth and land use type have a major impact on Madhubani soil quality. Long-term soil health and productivity depend on sustainable management approaches, particularly in orchard systems.

Keywords: *Soil Quality Index (SQI); Land Use Systems; Soil Depth; Organic Carbon; Nutrient Availability*

Indian Seed Industry**R D Vaidkar, U T Dangore, N V Shende and V K Khobarkar***PGI, Dr PDKV Akola, Maharashtra, India.***ABSTRACT**

The present study was based on the secondary data for the period of 2010 to 2022 of Indian seed industry. The compound growth rates for crop wise production of certified quality seeds is crucial for assessing the trends in agriculture. While cereals and pulses exhibit positive growth rates, attention is needed to address the decline in oilseed and fibre crop seed production. Balancing these trends can contribute to food security, improved crop quality, and sustainable agriculture. It's important to note that this positive compound growth rate suggests a general trend of progress. However, continuous efforts are needed to maintain and even accelerate this growth to meet the increasing global demand for quality seeds to support a growing population and address challenges like climate change and food security. Monitoring and supporting such growth is essential for the well-being of the agricultural sector and society as a whole. The CDVI provides insights into the stability of certified quality seed production in various crop categories. While individual crops exhibit varying levels of instability when adjusted for trends, the overall stability of seed production for all crops, when considered collectively, is relatively low. These indices help in understanding and addressing the challenges and opportunities in the Indian Seed Industry, especially in improving the stability and consistency of seed production. Considering all crop types collectively, the CDVI is 5.93. The CV of 14.25 implies a moderate level of variability in the production of certified quality seeds for all crops. However, the CDVI of 5.93, which is relatively low, indicates that when adjusted for trends, the overall instability in seed production for all crops is relatively low. This suggests that the instability may be influenced by short-term fluctuations rather than long-term trends.

Survey for the disease incidence on leaf rot of onion in major onion growing districts of Karnataka
Nataraja, K. D., Ambika, D. S. and Kirankumar, K. C.*Department of Plant Pathology, College of Horticulture, UHS Bagalkot, India.***ABSTRACT**

The roving survey was conducted in major onion growing areas during 2017-18 of Karnataka viz., Bagalkot, Chitradurga, Dharwad, Gadag and Vijayapura. In which from each district two taluk, from two villages from each taluk and two fields from each village during kharif season. Among different districts the highest disease incidence was recorded in Gadag district (16.5%), which was followed by Bagalkot (14.77%) and the least incidence was seen in Chitradurga district (7.37%).

The disease from all the surveyed districts ranged from 6.8 to 24 per cent.

Among the different districts Gadag district has shown the highest disease incidence (16.50%), the lowest disease incidence was recorded in Chitradurga district (7.37%). Among different taluks Rona of Gadag has shown the highest disease incidence (16.5%), Which was followed by Naragunda of Gadag (15.85%) and least incidence was shown in Challakere taluk of Chitradurga (7.35%). Among different villages Vasana village of Gadag district has shown the highest incidence (18.2%), which was followed by Abbigeri (17.6%), the least incidence of disease was observed in D. S. Nagara village of Chitradurga (6.9%).

Effect on Yield of Mungbean [*Vigna radiata* (L.) Wilczek] and Farmers income through Foliar Nutrition under Guava [*Psidium guajava* (L.)] based Agri-horti System**Visha Jain¹, Sandeep Arya¹, Pawan Kumar Poonia¹, Ayushi Jain², Sunil Kumar¹ and Rakesh Parasariya¹**¹*Chaudhary Charan Singh Haryana Agricultural University, Hisar, Haryana, India.*²*Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan, India.***ABSTRACT**

The present study was laid out in Randomized Block Design (RBD) with three replications and 10 treatments. Treatments involves foliar application of nano urea (4 ml/L), neem coated urea (2%), zinc (0.5%), and boron (0.2%) twice at pre flowering and pod development stages of Mungbean cv. Samrat. Results revealed that significantly maximum in morphological parameters viz. increased the plant height, number of branches, number of trifoliate leaves, and dry matter production/plant at all stages of plant growth except at 20 days sowing as well as yield parameters also shows significant increased in length of pod (6.9), number of pods/plant (27.33), number of seeds/pod (8.13), 1000 grain weight (40.2 g), grain yield (1358 kg/ha), straw yield (3043 kg/ha), biological yield (4402 kg/ha) and fruit yield (71 kg/ha) was showed in T10 (RDF + Nano urea 4 ml/L + 0.5% Zn + 0.2% B this resulted in the highest B:C ratio (4.1). A 10 year old Guava tree plantation with an average height (5.85 m), canopy diameter (5.60 m), stem girth (0.97 cm), and crown length (4.93 m). The study sought to determine how these foliar applications affect the overall growth and development of mungbean under spatial arrangement of guava trees compared to control.

Keywords: *Agroforestry; Sustainable; Economics; Foliar Nutrition***Effect of EMS mutation to improve the heat stress tolerant ability of Rice cultivars of N22****Nagalakshmi Sanivarapu¹, Puli Yugandhar², R.M. Sundaram², and Satendra K Mangrauthia²**¹*Biotechnology, Dr.YSRHU College of Horticulture, Pulivendula, India.*²*Indian Institute of Rice Research-ICAR, India.***ABSTRACT**

Heat is one of the major factors that considerably limit rice production. Nagina 22 (N22) is a deep-rooted, drought and heat tolerant a rice cultivar known for its ability to withstand heat and drought, has been extensively utilized in genomic studies to identify and characterize rice genes linked to tolerance against various abiotic stresses. In this particular study, we conducted screenings on N22 mutants induced by EMS to determine their enhanced tolerance to high temperature (HT) stress during both the seedling and reproductive stages. Four heat tolerant N22 mutants (NH363, NH663, NH733, and NH669) exhibited superior grain yield and spikelet fertility than N22 under HT Stress, Notably, NH733 displayed superior pollen fertility, stigma receptivity, spikelet fertility, photosynthetic rate, SPAD value, shoot length, root length, total dry weight, and antioxidant activity compared to N22 under high HT Stress conditions. We performed whole-genome RNA sequencing of NH733 revealed the commonly induced genes under three stress environments as well as the exclusive genes associated with specific stress. These results will be taken together, the mutant NH733 might serve as valuable genetic resources for the discovery of novel genes associated with heat stress tolerance in rice.

Keywords: *Oryza sativa; Abiotic stress; EMS mutagenesis; Nagina22; Yield*

Textural attributes of different formulations of Sapota Pulp and Millet based Fruit Loop Breakfast Cereals**R. Aruna¹, P. Jayamma¹, B Manjula², G Sailaja¹, Sajwa Tasneem¹ and Y Hari Hara Brahma¹**¹*Department of Food Safety and Quality Assurance, College of Food Science and Technology, ANGRAU, Pulivendula, Kadapa, A.P, India.*²*Department of Food Processing Engineering, College of Agricultural Engineering, Madakasira, Acharya N.G. Ranga Agricultural University, Andhra Pradesh, India.***ABSTRACT**

Seven formulations (T0–T6) of sapota-millet-based fruit loops were developed by varying the proportions of flours and sapota pulp. T0 served as the control, containing 25% each of wheat, corn, and oats flours with jaggery, excluding millet flour and sapota pulp. T1 included wheat, corn, oats flours, sapota pulp, and jaggery (20% each), while T2 contained the same flours and sapota pulp (25% each) without jaggery. T3 and T4 used ragi instead of wheat, with T3 including jaggery (20% each) and T4 is excluding it (25% each). T5 and T6 incorporated jowar similarly, with jaggery only in T5. Texture analysis was performed using a TA.XT Plus texture analyzer with a TA44 Probe. Hardness values (mean $\pm$ SD, n = 3) revealed significant differences ($P < 0.05$) among formulations. T1 ($7835 \pm 22.00a$), T3 ($7725 \pm 21.00a$), and T6 ($7775 \pm 12.00a$) recorded the highest hardness, grouped statistically together and indicating greater crispness. T0 ($3010 \pm 24.00e$) was the softest. T4, T5, and T2 showed intermediate hardness levels, with T4 firmer than T2 and T5, but softer than T1, T3, and T6. The results suggest that the type of millet and presence of jaggery influence the textural quality of the product. T1, T3, and T6 may be preferred for their crisp texture, aligning with consumer expectations for loop-type snacks. These findings highlight the role of formulation in determining product quality and potential shelf-life.

Keywords: *Sapota; ragi flour; wheat; jowar; texture profile analysis***Suitability of Organic Basmati Rice (*Oryza sativa*) - based Cropping Systems for Enhancing Productivity System under Sub-Tropical Agro Climatic Conditions of Jammu and Kashmir****Narinder Panotra, Romesh Kumar Salgotra, Vikas Sharma, Manmohan Sharma, Ritika Gupta, Shabnam Kundal, Sanjeevani Choudhary and Vasundra Wazir***Sher-e- Kashmir University of Agricultural Sciences and Technology of Jammu (J&K), India.***ABSTRACT**

The historic Research Centre for Organic and Natural Farming located at the Chatta campus of Sher-e-Kashmir University of Agricultural Sciences and Technology in Jammu and Kashmir, India, is designed to demonstrate the importance of organic farming practices under sub-tropical agro climatic conditions of Jammu and Kashmir. The Centre is working on organic nutrient management, organic weed management, organic disease management, organic cropping systems etc to enhance the farm income of Jammu and Kashmir. The objective of this research was to generate essential information about cropping systems for sustainable organic crop production as cropping systems are extremely important for the productive assets of agriculture and also improve soil fertility. To identify the most efficient organic basmati rice based cropping system for enhancing productivity system, 10 Basmati rice based cropping systems viz. Basmati rice–Wheat–Moong, Basmati rice–Wheat–Dhaincha, Basmati rice – Mustard–Moong, Basmati rice–Mustard–Mash, Basmati rice–Berseem–Mash, Basmati rice–Broccoli–Moong, Basmati rice–Berseem–Moong, Basmati rice–Lentil –French bean, Basmati rice–Methi–Dhaincha and Basmati rice–Pea– Dhaincha were studied under organic conditions. The experiments were laid out in Randomized Block Design with three replications. The results showed that the highest grain yield of 33.33 q ha^{-1} , straw yield of 79.80 q ha^{-1} , biological yield of 113.13 q ha^{-1} , harvest index of 29.46%, 1000- grain weight of 24.10 g, LCC of 58.82, leaf area of 4.52 cm^2 , number of tillers m^{-2} of

9.66 and plant height of 118.54 cm were obtained in Basmati rice – Berseem-Moong Cropping system which was found to be at par with the Basmati rice–Berseem–Mash Cropping system. Moreover, this system also gave highest rice equivalent yield (REY) of 77.70 q ha⁻¹, net returns of Rs. 282,435 ha⁻¹ and B: C ratio of 3.49.

Keywords: *Organic farming; basmati rice; cropping systems; productivity; equivalent yield*

Allelopathic potential of *Fumaria indica* (Hausskn.) Pugsley on some agronomic weeds

Mo Shadab and M.B. Siddiqui

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ABSTRACT

Weeds significantly affect crop productivity, causing an approximately 33% reduction in crop output and 20% in production costs. Chemical herbicides are preferred over manual weeding in large fields; however, this strategy is hazardous to the environment and human health. Allelopathy, in which plants release chemicals that inhibit neighbouring plant growth, has emerged as a weed control strategy in agriculture. This investigation examined the allelopathic potential of *Fumaria indica* (Hausskn.) Pugsley aqueous extract on germination and growth parameters including root length, shoot length, and biomass. Effects of leaf, stem, and root extracts on test plants (*Phalaris minor*, *Vicia villosa*, and *Rumex dentatus*) were dependent on extract concentrations, affecting germination rate and growth traits. Higher concentrations (2% and 4%) showed inhibitory effects, while 0.5% showed stimulatory effects on test plants. Leaf aqueous extract (LEA) exhibited the strongest inhibition compared to stem and root extracts, with inhibition order: leaf > stem > root. Based on the extract concentrations, pot-based analysis demonstrated a considerable decrease in the amount of photosynthetic pigments as well as a significant decrease in carbonic anhydrase activity. Proline and antioxidant enzymatic activities showed antagonistic concentration-dependent effects. Ultrastructural variations in test plant roots and leaves were analyzed through scanning electron microscopy. Root and leaf surface morphology altered in treated (4%) samples versus control. Confocal microscopic examination of root structures showed increased stained nuclei and membrane damage at 4% LAE concentration. The cytotoxic potential of LAE in onion root meristematic cells showed differential impacts on mitotic index and chromosomal aberrations. GC-MS analysis of leaf methanolic extract revealed 38 phytochemicals. Major compounds detected were protopine (16.91%), 3-cyclopentyl propionic acid (9.92%), n-hexadecanoic acid (7.27%), palmitic acid (21.88%), linoelaidic acid (20.45%), and 1-hentetracontanol (3.40%). These results suggest that the allelopathic potential of *F. indica* aqueous extract on *P. minor*, *V. villosa*, and *R. dentatus* is attributable to the allelochemicals observed in *F. indica*. Therefore, these allelopathic compounds may be utilized for the sustainable management of weeds, contributing to organic and residue-free farming practices.

Keywords: *Allelochemicals; Germination Percentage; GC-MS; Scanning Electron Microscopy (SEM); Confocal microscopy; Mitotic index; Chromosomal aberrations*

Strategic Tree-Crop Integration: Evaluating Oat Performance in Melia dubia-Based Agroforestry Systems in Semi-Arid Haryana**Sumit, Sandeep Arya and Sushil Punia***Department of Forestry, COA, CCS Haryana Agricultural University, Hisar, Haryana, India.***ABSTRACT**

An experiment was conducted in a farmer's field located in the village Gillan Khera, situated in the western semi-arid region of Haryana's Fatehabad district during the Rabi season of 2021-22. The aim was to assess the performance of three oat varieties (OS-6, OS-7, and OS-403) within a 7-year-old *Melia dubia* plantation with a spacing of 3m × 3m. The mean values of various tree growth parameters such as tree height (17.8 m), diameter at breast height (59.5 cm), and canopy spread (8.5 m) were found to be higher in agroforestry rather than in the pure stand of *Melia dubia* after harvest of the crop. Plant growth parameters and yield attributes exhibited significantly higher in open conditions compared to those under the plantation. Among the oat varieties, OS-403 exhibited superior growth traits in all evaluated parameters. Oat variety OS-403 showed the maximum green fodder and dry fodder yields. Significant increases were observed in parameters such as plant height at different growth stages, number of tillers per meter row length, leaf stem ratio, and leaf area index in OS-403. Conversely, OS-6 showed lower growth parameters and yield in both conditions. Light intensity shows an increase throughout the day, reaching its peak at 2:00 p.m. under both conditions. For example, at 2:00 p.m., light intensity rises from 515.5 lux (30 DAS) to 934.9 lux (maturity) in the average values. The reduction in yield with decreasing spacing may be attributed to the shading effect of trees on crops. However, the long-term accumulation of wood from trees is expected to yield greater economic returns in the future.

Keywords: *Melia dubia*; Agroforestry; Canopy Spread; Oat Varieties; Growth Parameters; Leaf Stem Ratio; Leaf Area Index; Light intensity

Effect of different doses of fertilizer, spacing, variety in b:c ratio of pea (*Pisum sativum* L.)**Manshi¹, Amit Saurabh², Vedika Sharma³, Deeksha Kumari¹, Sanskriti¹**

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ABSTRACT

A field experiment was conducted at Department of Horticulture, Eternal University at Sirmaur (H.P) to find out effect of different doses of fertilizer, spacing, variety on benefit cost ratio of pea (*Pisum sativum* L.). The study aimed to determine the most economical and efficient combination of inputs for maximizing profitability in pea (*Pisum sativum* L.) cultivation. The experiment followed a randomized block design with three replications and sixteen treatments, involving four Nano DAP concentrations (0% control, 75% RDF, 100% RDF and 125% RDF), two spacings (30 × 15 cm and 45 × 15 cm) and two varieties—ADV-12 and GS-10. The findings demonstrated that both individual and interaction effects of fertilizer levels, spacing, and varieties significantly influenced the B:C ratio. The combination of 100% RDF Nano DAP with wider spacing (45 × 15 cm) in variety GS-10 recorded the highest B:C ratio, attributed to better plant growth, higher yield per plant, and optimum input cost. On the other hand, the control treatment (0% RDF) consistently resulted in lower economic returns and yield, regardless of spacing or variety. Variety ADV-12 performed relatively well under closer spacing and higher fertilizer dose (125% RDF), achieving good yield but with a slightly reduced B:C ratio due to

elevated input costs. Overall, the application of 100% RDF using Nano DAP emerged as the most efficient and cost-effective strategy for both varieties. The study highlights the importance of integrating suitable spacing, appropriate Nano DAP levels, and variety selection to enhance economic returns in pea farming. These findings can guide farmers toward input optimization for sustainable and profitable crop production.

Antimicrobial Potential of Euphorbiaceae Plants: A Comprehensive Review of Bioactive Compounds, Mechanisms, and Therapeutic Applications

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Introduction

The escalating global crisis of antimicrobial resistance necessitates the urgent development of novel therapeutic agents. The family Euphorbiaceae, comprising over 7,500 species distributed worldwide, represents a rich reservoir of bioactive secondary metabolites with promising antimicrobial potential. Despite extensive traditional use of these plants for treating infectious diseases, a comprehensive evaluation of their antimicrobial properties remains lacking.

Objectives

This review systematically examines the antimicrobial activities of selected Euphorbiaceae plants, evaluating their bioactive compounds, mechanisms of action, and therapeutic potential against pathogenic microorganisms.

Methods

A comprehensive literature search was conducted across PubMed, Scopus, Web of Science, and Google Scholar databases (2000-2024) using keywords related to Euphorbiaceae, antimicrobial activity, and bioactive compounds. Studies reporting in vitro and in vivo antimicrobial activities, phytochemical analyses, and mechanism investigations were included following predetermined inclusion criteria.

Results

The review encompasses 156 studies investigating antimicrobial properties of 45 Euphorbiaceae species across 12 genera. Key findings reveal that *Euphorbia hirta*, *Jatropha curcas*, *Ricinus communis*, and *Croton* species demonstrate significant broad-spectrum antimicrobial activities with minimum inhibitory concentrations (MIC) ranging from 12.5-500 µg/mL against various bacterial and fungal pathogens. Major bioactive compounds include diterpenes, triterpenes, flavonoids, and phenolic acids. Primary mechanisms involve cell membrane disruption, enzyme inhibition, and oxidative stress induction. Several species show promising anti-biofilm properties and synergistic effects with conventional antibiotics.

Conclusions

Euphorbiaceae plants represent a valuable source of antimicrobial agents with diverse chemical scaffolds and novel mechanisms of action. While promising in vitro activities are well-documented, translation to clinical applications requires standardized extraction protocols, comprehensive toxicity evaluations, and well-designed clinical trials. Future research should focus on structure-activity relationships, formulation development, and sustainable production strategies to harness the full therapeutic potential of these natural antimicrobials.

Keywords: *Euphorbiaceae; Antimicrobial activity; Phytochemicals; Bioactive compounds; Drug resistance; Secondary metabolites; Therapeutic potential*

Zero Waste for Optimization of Gooseberry Processing to Create More Sustainable and Profitable Enterprise**K.Lalmalsawmi***Krishi Vigyan Kendra, Serchhip, Mizoram, India.***ABSTRACT**

Emblica officinalis, also known as Indian gooseberry, is a deciduous tree of the family Phyllanthaceae. Its native range is tropical and southern Asia. It is the most important medicinal plant in the Indian traditional system of medicine, the Ayurveda. The tree is small to medium in size, reaching 1-8 metres in height. The branchlets are finely pubescent, 10 – 20 cm long, usually deciduous. The leaves are light green, resembling pinnate leaves. The flowers are greenish-yellow. The fruit is nearly spherical, light greenish yellow and hard on appearance and the fruit is up to 26mm in diameter and weighs approximately 5.5g. Various parts of the plant are used to treat a range of diseases, but the most important is the fruit. The fruit is used either alone or in combination with other plants to treat many ailments such as common cold and fever, and other ailments. In addition, experimental studies have shown that amla and some of its phytochemicals, such as gallic acid.

Amla (Indian Gooseberry) processing involves several stages, including cleaning, cutting, pulping and further processing into various products. Common processing methods include pulping for juice extraction, dehydration for powder production, and direct use in products like preserves, candies and pickles. To achieve zero-waste in Gooseberry processing, the focus should be on utilizing all parts of the fruit, minimizing waste and finding beneficial uses of byproducts.

N.Vanlaiphai, Serchhip District is the main center of Amla processing in Mizoram, India. They usually produce Amla juice, candy and powder. Here is how they approached zero waste in amla processing. The first innovative processing technique with Amla de stoning machine to separate the pulp from the seeds and utilizing Pomace (left over pulp after juice extraction) to produce Amla infused oil. The remaining seeds are supplied to the nurseries.

Comparative Performance of Hybrid Tomato under Protected and Open Field Condition**M. U. Kale, M. M. Deshmukh, M.S.Supe***Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, India.***ABSTRACT**

The field experiment was conducted under protected and open field condition during rabi season of 2023-2024 consisting of five drip fertigation levels viz T1 (Drip fertigation at 60 % RDF), T2 (Drip fertigation at 80 % RDF), T3 (Drip fertigation at 100 % RDF), T4 (Drip fertigation at 120 % RDF) and T5 (Traditional fertilization at 100 % RDF through solid fertilizers) for hybrid tomato crop. Yield of tomato was found maximum (329.91 q/ha) in treatment T4 (120% RDF) for open field, while maximum yield was obtained (515.28 q/ha) in treatment T3 (100% RDF) under protected structure. Water use efficiency was found maximum in treatment T4 (120% RDF) followed by treatment T3 (100% RDF) for open field, while it was found maximum in treatment T3 (100% RDF) under protected structure.

Keywords: *Tomato; RDF; protected structure; fertigation*

Impact of climate change on Agriculture in Western Vidarbha Region**M.S.Supe, M. U. Kale***Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, India.***ABSTRACT**

Agriculture in western Vidarbha is rainfed dominant. Effect of climate change scenario on agriculture in western Vidarbha was analysed using water requirement of rainfed crops. It was observed that maximum temperature and rainfall has decreasing while minimum temperature and rainy days has increasing trend. The crop water requirement of rainfed crops viz cotton, soybean and pigeon pea was observed decreasing over western Vidarbha region.

Keywords: *Climate change; agriculture; Vidarbha; rainfed; water requirement*

Strengthening Tribal Livelihoods through Dairy Value Addition and Market Integration**Dr. Arpita Sharma Kandpal and Dr. Jitendra Kwatra***GBPUA&T, Pantnagar, India.***ABSTRACT**

This paper investigates the potential of dairy-based entrepreneurship as a means to enhance livelihoods among tribal communities, with a focus on their current knowledge of milk value addition and marketing practices. The study was conducted in selected tribal villages through a structured knowledge assessment involving 100 respondents. The tool comprised ten thematic areas including milk processing techniques, hygiene protocols, preservation and packaging methods, branding, market awareness, and knowledge of government schemes. Findings reveal significant knowledge gaps. Results revealed that only 38% of respondents were familiar with common value-added dairy products such as paneer, ghee, and curd, while 34% demonstrated an understanding of basic processing methods. Awareness regarding hygienic practices for safe dairy processing was found in 42% of respondents, and just 39% were aware of preservation techniques to enhance product shelf life. Packaging and labelling knowledge stood at 37%, and only 33% had any familiarity with government schemes relevant to dairy enterprises. Furthermore, only 40% of respondents were aware of cold storage options, 36% had insights into local market demands, 35% could carry out basic cost estimations, and merely 32% understood branding or promotional approaches. These findings highlight the critical need for comprehensive capacity-building programs tailored for tribal populations. Such programs should emphasize both technical competencies in dairy value addition and essential skills such as market orientation, financial planning, and awareness of institutional support systems. The study concludes that targeted training and sustained support mechanisms can significantly contribute to tribal empowerment by facilitating the establishment of micro-enterprises, enhancing household nutrition, and promoting inclusive economic development.

Keywords: *Tribal communities; dairy entrepreneurship; value-added milk products; market integration; rural development*

Advanced transfer of technology methods for smart agriculture**Sarvesh Kumar***Department of Extension Education, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, (UP), India.***ABSTRACT**

The term smart agriculture may also use as precision agriculture. The smart agriculture is furnished with use of advanced technologies and data-driven solutions to optimize farming practices and improve agricultural productivity, sustainability and resource use efficiency. Smart agriculture integrates modern

tools such as sensors, Internet of Things (IoT), data analytics, artificial intelligence (AI), and automation to make farming more precise and resource-efficient.

Agricultural extension is key to providing information, services, technologies and skills. It impacts nutrition, health, food security, poverty reduction, livelihoods, jobs, climate adaptation and mitigation, gender equality, youth and social inclusion, environmental health and biodiversity on earth. As per the traditional methods we were assuring ToT with individual methods, group methods and mass contact and participatory methods. Now the agriculture's needs have expanded at large and connect with huge number of practitioners and beneficiaries at a time in critical need is a challenges for traditional ToT methods hence modern ToT methods are required to convert in smart agricultures by using modern methods like ICT-based methods, digital platforms & social media, farmer-centric participatory approaches, remote sensing & smart farming tools, public-private partnerships (PPP) & Agri-startups, AI, machine learning & decision support systems and E-extension & virtual knowledge centers are very crucial initiatives for converting traditional agriculture to smart agriculture system for sustainable production and food security of mounting population globally.

Keywords: *ToT; smart agriculture; traditional agriculture; AI; digital tools; food security; productivity*

Response of sowing dates of safflower on growth and seed yield in changing climatic condition

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ABSTRACT

An investigation was undertaken at Oilseeds Research Unit, Dr. PDKV, Akola, Maharashtra during Rabi season of 2022-23 to 2024-25 to find out suitable sowing dates for safflower crop and to find out suitable varieties of safflower in changing climatic condition. The experimental site was fairly uniform in topography with clayey in texture and slightly alkaline in reaction. It was low in available nitrogen, medium in available phosphorus and rich in potash with moderate organic carbon. The experiment was laid out with twelve treatment combinations in split plot design with three replications. Main plot consists of four sowing dates (S) viz. sowing in 39th MW (S₁), 41th MW (S₂), 43th MW (S₃), 45th MW (S₄) and sub plot consists of three varieties namely AKS-207 (V₁), PKV-Pink (V₂) and AKS-351 (V₃). The differences were significant among all the sowing dates in respect of the seed, straw and biological yield. Result indicated that, the sowing of safflower at 41 MW (2nd Week of October) was produced highest growth attributes, significantly superior yield (2085 kg/ha) and Stalk yield (4845 kg/ha) amongst the four date of sowing on the basis of yield and economics followed by 43 MW sowing produced Seed yield (1681 kg/ha) and Stalk yield (3983 kg/ha), however, the significantly highest seed yield recorded by variety AKS-351 (1906 kg/ha) when sown during second week of October. Quality parameter characters viz. protein content, protein yield and oil content, oil yield was significantly higher with sowing in 41st MW (S₂) followed by sowing in 43rd MW (S₃), 45th MW (S₄) and 39th MW (S₁). Sowing of safflower during the 41st MW (S₂) recorded higher oil and protein yield, GMR (Rs.120983), NMR (Rs. 82701) and B: C ratio (3.29) compared to sowing in 43rd MW (S₃), 45th MW (S₄) and 39th MW (S₁). Variety AKS-351 (V₃) showed significant improvement in growth attributes, yield attributes and recorded highest seed oil and protein yield, GMR (Rs. 109483), NMR (Rs. 73350) and B:C ratio (3.06) as compared to PKV-Pink and AKS-207.

Keywords: *Safflower; Genotypes; Sowing dates; climate change*

Hi-tech Horticulture, Food Processing, and Value Addition in India and Nepal**Sunil Kumar***Department of Vegetable Science, CCS Haryana Agricultural University, Hisar, India.***EXTENDED SUMMARY****Introduction**

Hi-tech horticulture, when integrated with food processing and value addition, offers a powerful solution to increase productivity, minimize post-harvest losses, and improve farmer incomes in South Asia. India and Nepal, with growing horticultural sectors, face challenges of inefficiency in input use and post-harvest management.

Objectives

- To assess the role of hi-tech horticulture in boosting productivity
- To evaluate methods for reducing post-harvest losses through processing
- To explore the economic and employment benefits of value addition

Methods

The study synthesizes recent production data from India (351.9 MT in 2023) and Nepal (10.5 MT), government reports, and research publications. Focus is placed on technologies like protected cultivation, fertigation, micro-irrigation, hydroponics, and post-harvest innovations. Schemes like PMFME and MIDH in India and Nepal's Agriculture Development Strategy are analyzed.

Results

Hi-tech interventions led to a 20–40% yield increase and better input use efficiency. Post-harvest losses remain high: 15–30% in India and 20–25% in Nepal. Value addition via dehydration, pulping, canning, and RTE products can reduce these losses while increasing income by 30–40%. Public-private partnerships promote innovations such as solar dryers and village-level processing units. Food processing contributes 11.4% to India's agri-GVA, and both countries are fostering agro-industrial growth and entrepreneurship.

Conclusion

The integration of hi-tech horticulture with efficient processing and value addition is crucial for achieving climate-smart agriculture, rural employment, and food security in South Asia. It holds the key to economic resilience, sustainability, and improved livelihoods for farmers in India and Nepal.

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Value Addition in Fruits and Vegetables for Income Generation through SHGs**Mayank Mehra, K.S. Yadav and Gayatri Mehra***Krishi Vigyan Kendra Sagar, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, Madhya Pradesh, India.***ABSTRACT**

It has been found that Processing and Value addition of Fruits and Vegetables has high trainability, low investment and potential for Sustainable Income Generation for women SHGs.

Value addition refers to the process of transforming raw agricultural products into more valuable forms through processing, packaging, and improved preservation techniques. This process enhances not only the nutritional quality of food but also provides economic benefits to farmers, producers, and local communities. The advantages of value-added agricultural products include improved nutrition for children and mothers, increased farmer income, expanded market opportunities, and better food safety through advanced packaging and storage techniques. Enhancing value in agriculture is crucial for improving farmers' profitability, empowering rural communities, ensuring the availability of high-quality branded food for consumers, reducing post-harvest losses, boosting exports, and encouraging the development of supporting industries. Every year, a significant number of fruits and vegetables are wasted due to inadequate post-harvest management. Post-harvest losses range from 20-50% in developing nations and 10-15% in developed countries.

Both traditional and modern food processing techniques play a vital role in diversifying food supplies, creating employment opportunities, and generating income. Processing and preserving both major and underutilized fruits and vegetables can minimize post-harvest losses and ensure nutritional security, especially during off-seasons. This book on Value Addition in Horticultural Crops aims to be a valuable resource for teachers, students, scientists, industrialists, NGOs, self-help groups (SHGs), farmers, and farm women. To make fruits and vegetables more marketable, it is essential to adopt post-harvest technologies and efficient logistics. Value-added products not only command higher prices for growers but also ensure better quality standards for domestic and international markets. Additionally, they strengthen rural economies, reduce waste, and encourage small-scale industries. Various techniques used in processing fruits and vegetables have shown great promise in extending shelf life and improving economic viability.

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Efficacy Of Indigenous Entomopathogenic Fungi Against *Spodoptera Litura* (Fabricius) In Groundnut Ecosystem**Vinod Kumar Nirmalkar and Sanjay Kumar Verma***Bio-control Laboratory, BTC College of Agriculture & Research Station, Sarkanda, Bilaspur, (I.G.K.V.) (C.G.), India.***ABSTRACT**

The increasing resistance of insect pests to synthetic insecticides and the adverse ecological impacts of chemical pest control have necessitated the exploration of sustainable biological alternatives. Entomopathogens, particularly fungi, represent a promising system for the environmentally compatible management of insect pests. Among these, *Spodoptera litura* (Fab.), a major polyphagous lepidopteran defoliator, poses a serious threat to groundnut (*Arachis hypogaea* L.) cultivation, with larval infestations causing up to 25.8% yield loss. The pest infests over 100 plant species and severe during the rainy and post-rainy seasons. In the present study, three locally isolated entomopathogenic fungi (EPF)—*Beauveria bassiana*, *Metarhizium anisopliae*, and *Aspergillus flavus* were evaluated under field

conditions against *S. litura* in groundnut. Each isolate was applied at three different concentrations, 1×10^7 , 1×10^8 , and 1×10^9 cfu g⁻¹.

A chemical insecticide formulation (Novaluron 5.25% + Indoxacarb 4.5% SC) was used as a standard check for comparison. Results revealed that the chemical standard exhibited the highest larval mortality (85.61%) and pod yield (35.86 q ha⁻¹). Among the fungal treatments, *A. flavus* at 1×10^9 cfu g⁻¹ resulted in the highest larval mortality (72.02%) and pod yield (32.52 q ha⁻¹), followed by *M. anisopliae* (68.14%). In contrast, *B. bassiana* at the lowest concentration (1×10^7 cfu g⁻¹) was the least effective, with only 14.02% mortality and 9.98 q ha⁻¹ yield. A clear dose-dependent response was observed, with increasing concentrations of EPF corresponding to significantly enhanced pest suppression and crop productivity. The findings substantiate the potential of high-density formulations of indigenous EPF, particularly *A. flavus* and *M. anisopliae*, as effective bio-control agents for the sustainable management of *S. litura* in groundnut. Their integration into existing Integrated Pest Management (IPM) frameworks could reduce chemical dependency, delay resistance development and ensure long-term agro-ecosystem stability.

Keywords: *Spodoptera litura*; Entomopathogenic fungi; *Aspergillus flavus*; *Metarhizium anisopliae*; *Beauveria bassiana*; Groundnut; Biological control

Nutritional Security among Rural Women and Children through Nutritional Kitchen Gardens in Panchmahal District

Renu Godara, Shakti Khajuria, Kanak Lata and J.K. Jadav

Krishi Vigyan Kendra (CIAH-ICAR), Panchmahal, Gujarat, India.

ABSTRACT

The Panchmahal district of Gujarat has been identified as a nutritionally vulnerable area, with severe iron and vitamin A deficiencies reported in the NFHS-V (2019–21) survey. To address this, a nutritional intervention in the form of *Nutritional Kitchen Gardens* was implemented during the Rabi season. The technology was adopted from JNKVV, Jabalpur, and introduced in selected villages of Panchmahal district with the objective of improving health and dietary habits among rural farm families. A total of 12 farm families were involved in the demonstration, where they were guided to grow nutrient-rich vegetables in their own backyards ~200m² area. The 200 m² area was selected to optimize the effectiveness of the kitchen gardening demonstration both as a training tool and as a research platform to evaluate production potential, input efficiency, and ecological benefits in a peri-urban or semi-rural context. The focus was on green leafy vegetables such as spinach, fenugreek, coriander, and mustard leaves, along with iron- and carotenoid-rich vegetables like beetroot, cauliflower, french bean, peas, mogra, and carrot. These vegetables are rich in iron and carotenoids, which are precursors of vitamin A, essential for combating nutritional deficiencies. The results of the intervention were highly promising. Vegetable consumption among participating families increased significantly from 85 grams to 110 grams per person per day, marking a 29.41% rise in intake. Additionally, the financial impact was notable. Monthly expenditure on vegetables dropped drastically from ₹1200 to ₹300 per family, indicating a 75% reduction in spending on market-purchased vegetables. Farmers expressed positive feedback, noting that the availability of fresh, homegrown vegetables improved their family's nutrition while reducing dependency on the market. The success of this initiative demonstrates that nutritional kitchen gardens are an effective, low-cost, and sustainable approach to improving dietary diversity, addressing micronutrient deficiencies, and enhancing the overall well-being of rural households.

Keywords: *Nutritional kitchen garden*; *Food security*; *Nutritional deficiencies*; *nutritional intervention*

Experiment study on Hermetic storage of Grain to Prevent Post Harvest Losses**Ashok Kumar¹ and Manish Kumar²**¹Deptt. of Agricultural Engineering, Bihar Agricultural College, BAU, Sabour, Bhagalpur, Bihar, India.²Deptt. of Agricultural Engineering, Nalanda College of Horticulture, Noorsarai, BAU, Sabour, Bhagalpur, Bihar, India.**ABSTRACT**

Hermetic technologies are being promoted in Bihar as safer and more effective methods of grain storage on small farm holder. However, farmers and policy makers lack knowledge of their efficacy in controlling major stored grain pests. A present research was carried out to investigate the effect of hermetic bags on maize grain quality comparing with different packing materials (Plastic bags, metallic container, pusa bin) for 12 months of storage. Moisture content, lightness were recorded for 15 days interval for first two months thereafter 30 days interval till end of storage period. When the plastic bags, metallic container and earthen bin were used as the packing material, the moisture content and lightness were decreased as moisture increased from 12.07-14.67% (wb) which decreases the lightness (L) from 71.01 to 67.05. When grain was packed in metal, earthen bins and plastic bags, the reduction in viability of seed with time of storage varied with the moisture content of seed at packing. When Maize stored in super grain bags with initial moisture content of 12.07% showed satisfactory temperature, moisture content and lightness throughout the storage period resulting in better germination rate than those packed in other packaging materials like plastic bags, metallic container and mud bin with same moisture content.

Keywords: Plastic bags; gunny bags super grain bag; milling quality; moisture content**Performance evaluation of small-scale solar-powered milk chiller****Ashok Kumar¹ and Manish Kumar²**¹Deptt. of Agricultural Engineering, Bihar Agricultural College, BAU, Sabour, Bhagalpur, Bihar, India.²Deptt. of Agricultural Engineering, Nalanda College of Horticulture, Noorsarai, BAU, Sabour, Bhagalpur, Bihar, India.**ABSTRACT**

Milk storage after milking is a difficult problem in India, particularly in rural regions. Commercial chilling facilities do exist, but many milk farmers cannot afford them due to their high cost and energy requirements. To overcome this problem, a solar assisted milk chiller Insitu condition with a storage capacity of 40 lit was designed. The system is powered by a solar panel, a battery and refrigeration unit. The cooling time, drop in temperature and coefficient of performance (COP) was determined to know the performance of developed milk chiller. The standard plate count (SPC) and methylene blue indicator test (MBRT) was also done to assess the keeping quality of milk. There was a significant temperature drop of 4° with 50 and 100 min of cooling time under no load and full load condition. The result obtained from observation revealed that the quality of milk stored for 48 h at 4°C has almost the same quality as fresh milk with insignificant growth of microbes. The SPC in the chilled milk was ranged from 2.31×10^5 - 2.46×10^5 cfu/ ml resulting milk safer for consumption. The average COP for no load and full load condition was ranged from 1.0 to 1.4. A cost-effective solar-powered milk chilling system A useful method for temporarily keeping milk after milking, the insitu solution successfully meets the demands of milk producers in rural areas.

Keywords: solar photovoltaic; chiller; solar energy; vapour compression cooling

Traditional and Herbal Medicines for Immunity: A Scientific Perspective**Kavita Chahal¹ and Vibha Choudhary²**¹*Dept of Botany, Government Science College, Jabalpur M.P, India.*²*Dept of Physics, Government Science College, Jabalpur M.P, India.***ABSTRACT**

Traditional herbal medicine has long played a vital role in enhancing immune function across cultures. With growing interest in natural health solutions, scientific research has begun to validate the immunomodulatory effects of various herbs. This paper explores the mechanisms, efficacy, and integration of traditional herbal remedies in immune support, highlighting key botanicals such as *Withania somnifera*, *Tinospora cordifolia*, *Ocimum sanctum*, and *Curcuma longa*. It also discusses the bioactive compounds responsible for immune modulation and the challenges in standardizing herbal treatments.

Keywords: *Curcuma longa*; *Immunomodulatory*; *Ocimum sanctum*; *Tinospora cordifolia*; *Withania somnifera*

Low Tunnel Technology in Vegetable Production**Sanjay Seemawat***Department of Horticulture, Rajasthan College of Agriculture Maharana Pratap University of Agriculture and Technology – Udaipur, Rajasthan, India.***ABSTRACT**

Vegetables provide all the nutrients ingredients viz., vitamins, minerals, protein and nutraceutical properties that are essential for balanced diet, which makes vegetables protective food. In order to enhance the quality production and productivity per unit area of vegetable crops, protected cultivation technologies may be opted. In India, because of increase in consumers' awareness for health and high population pressure, the demand of vegetables is gradually increasing day by day. India is the second leading vegetable producing country in the world after China. Now a days, the increasing demand of off-season and high-quality vegetables in various markets of the county has got the attention of the vegetable growers for diversification from traditional way of vegetable cultivation to modern methods of vegetables cultivation in an agri-business model. A wide variety of structures such as hotbeds, glass cloches, cold frame, low and high tunnels and various types of greenhouses have been used as protected systems to extend the growing season. Low poly tunnel vegetable production technology plays a vital role in addressing the challenges posed by climate change, particularly in agriculture. These tunnels, made from simple and cost-effective materials like polyethylene sheets stretched over metal or plastic frames, create a controlled microclimate that protects crops from extreme weather events such as heavy rainfall, frost, and heat waves—conditions that are becoming more frequent and severe due to climate change. By providing a stable environment for plant growth, low poly tunnels help farmers adapt to shifting climate patterns, enabling them to grow vegetables year-round and reduce the risks of crop failure.

This technology is especially beneficial for smallholder farmers in developing countries, where resources are limited and climate impacts are more acutely felt. Additionally, low poly tunnels can contribute to climate change mitigation by reducing the need for synthetic fertilizers and pesticides, improving water efficiency, and promoting local food production, which lowers greenhouse gas emissions associated with transportation. However, challenges such as plastic waste and durability of materials must be addressed to make this technology more sustainable. Overall, low poly tunnels represent a practical and scalable solution for enhancing food security and agricultural resilience in the face of climate change. Low tunnels are miniature structures producing greenhouse like effect. In these

tunnels, plastic sheets are used for roof covering of the tunnel with shaped construction having low height, which is built with steel bars. These tunnels facilitate the entrapment of carbon dioxide, thereby enhancing the photosynthetic activity of the plants and hence the yield. These structures also protect the plants from the high winds, rain, frost and snow. Besides being inexpensive, they are easy to construct and dismantle. Growth parameter and yield attributing characters were significantly influenced by different low-cost low tunnel height and onion varieties. Poly tunnel condition found to be the best for higher off-season production of muskmelon and fetch higher return.

Keywords: *change-climate; low poly tunnel; environment; quality vegetable; low cost; off-season; marketing; farmers; early production*

Isolation and characterization of phytopathogenic microbes from plant phyllosphere for phytotoxicity against *Echinochloa colona*

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ABSTRACT

A study was conducted to isolate phytopathogenic microorganisms from the phyllosphere of plants to characterize their phytotoxic potentials against *Echinochloa colona*. Microbes were isolated from the phyllosphere of four millets [Barnyard (SN), Kodo (KD), Kutki (KT), Foxtail (FX)], *E. colona* (EC) and *Aegle marmelos* [Bel Patra (BP)]. A total of 30 microbes (21 bacterial and 9 fungal) were isolated and characterized for total phenol content and cellulase enzyme activity. Based on these parameters, 15 isolates, BP-1, BP-4, SN-1, SN-2, SN-3, KT-4, KT-5, KD-5, FX-1, FX-2, and EC-1-5 were selected for phytotoxicity test against *E. colona*. The total phenolic content (TPC) ranged from 12 to 19 GAE mg/ml, while cellulase activity varied between 0.131 and 6.875 mg G/g/day. A leaf-dip test was performed to assess the phytotoxic effects of these isolates on *E. colona* leaves. *E. colona* leaves were surface sterilized and incubated with CFE of isolates. After 48 hours of incubation, isolate numbers FX-1, KT-5, EC-3, EC-5, SN-2, SN-3, BP-1, and BP-2 showed chlorotic symptoms on *E. colona* leaves.

Keywords: *Echinochloa colona; phytotoxicity; phytopathogens; phyllosphere; biological weed management*

Background for Presentation on Sustainable Approaches to Managing Food Safety Business Risks in a Changing Climate

Mohammad Khurshed Alam Khan

Divisional Food Safety Research & Development ITC Hotels

FSMS and its Industrial Acts and Regulations

ABSTRACT

Foodborne diseases remain a critical global public health concern, contributing to significant illness, death, and economic loss each year. This burden is particularly acute in low- and middle-income countries, including India, where the implications of unsafe food are often under-researched and under-addressed. As climate change increasingly influences food systems, sustainable approaches to managing food safety risks in business operations are more important than ever.

This presentation explores the intersection of food safety, economic risk, and sustainability in the context of a changing climate. It highlights the global prevalence and distribution of foodborne diseases, citing World Health Organization data that estimates 600 million cases of illness and 420,000 deaths annually due to contaminated food - disproportionately affecting children under five and populations in vulnerable situations.

The discussion also examines key food vehicles and the leading causes of outbreaks, based on WHO's 2015 global burden estimates of 31 major foodborne hazards. These challenges underscore the urgent need for enhanced food safety systems, particularly in economies where healthcare infrastructure and regulatory oversight may be limited.

Economically, the impact is substantial. WHO estimates that unsafe food costs low- and middle-income countries around US\$110 billion annually in lost productivity and medical expenses. Complementing this, the 2019 World Bank report highlighted an additional \$95.2 billion in productivity losses. Meanwhile, initiatives such as the Asian Development Bank's \$14 billion commitment between 2022–2025 reflect growing recognition of the need to bolster food safety and security against climate-induced threats.

In conclusion, strengthening food safety practices through sustainable, climate-resilient approaches is both a public health priority and a business imperative. By identifying and mitigating food safety risks, businesses can protect public health, reduce healthcare costs, build consumer trust, and achieve long-term economic resilience. Safe agricultural produce is foundational to safe food systems, and investing in food safety is essential for sustainable growth in an increasingly climate-impacted world.

Post-Harvest Loss Reduction of Fruits and Vegetables through Plastic Crates

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ABSTRACT

Post-harvest losses of fruits and vegetables are a major issue for farmers, especially during harvesting and transportation. A 2022–23 survey by ICAR/NCCD estimated post-harvest losses at approximately 19% for fruits and 18% for vegetables annually. In Panchmahal district, most farmers traditionally use polybags or sacks, which often lead to physical damage of fresh produce due to pressure and vibrations. To solve this problem, a technology was adopted from CIAE, Bhopal—the use of reusable plastic crates for handling fruits and vegetables. This low-cost, reusable technology was introduced to farmers through 12 field demonstrations during the year 2024–25. The plastic crates help in proper organization, better aeration, and reduced damage during both harvesting and transport. Unlike sacks, plastic crates prevent the piling of produce, thus reducing pressure and bruising. As a result, the quality of vegetables and fruits remains intact, allowing farmers to fetch better prices in the market. The results were very promising. The physical injury to produce was reduced from 8.50 kg per quintal (using polybags/sacks) to 4.75 kg per quintal when plastic crates were used. This shows a 44% reduction in post-harvest losses. Farmers gave positive feedback, reporting that plastic crates not only reduced spoilage but also increased the efficiency of loading and unloading, saving time and effort. Farmers also noticed an improvement in their income due to the sale of better-quality produce. The technology proved to be useful, especially for vegetables and fruits that are easily damaged, and it offers a simple, effective solution to post-harvest loss in rural areas. This initiative demonstrates that plastic crates are a sustainable and farmer-friendly technology that can improve post-harvest handling, reduce losses, and increase farmers' profits in Panchmahal district and similar regions.

Keywords: *Post harvest losses; Agriculture produce; Plastic crates; Farmer friendly technology*

Direct and residual effect of integrated use of organics and inorganics on soil total carbon stock and carbon sequestration potential under rice-sorghum cropping system**G. K. Surya Krishna¹, Ch. Sujani Rao², P. Venkata Subbaiah³, M. Sree Rekha⁴, V. Srinivasa Rao⁵**¹*Department of Soil Science and Agricultural Chemistry, SMGR Agricultural College, Udayagiri, India.*²*Soil Science, RARS, Lam, Guntur, India.*³*Department of Soil Science and Agricultural Chemistry, S.V. Agricultural College, Tirupati, India.*⁴*Department of Agronomy, Agricultural College, Bapatla, India.*⁵*Department of Statistics and Computer Applications, Agricultural College, Naira, India.***ABSTRACT**

A field experiment was conducted for two consecutive years 2020-2021 and 2021-2022 on clay loam soil at Agricultural College Farm, Bapatla to study the direct and residual effect of integrated use of organics and inorganics on soil total carbon stocks and carbon sequestration potential under rice-sorghum cropping system. The results revealed that, among the treatments applied to Kharif rice at harvest stage the highest total carbon, total carbon stock was recorded in T₇ i.e., 100% RDF + 25% N through FYM and it was on par with the treatment T₄ i.e., 75% RDF + 25% N through FYM, 100% RDF + 12.5% N through FYM + 12.5% N through GLM (T₉) and 75% RDF + 12.5% N through FYM + 12.5% N through GLM (T₆), whereas highest carbon sequestration potential was recorded in T₇ i.e., 100% RDF + 25% N through FYM and it was on par with T₄ which received 75% RDF + 25% N through FYM during the two years of study. In succeeding sorghum, the organics, inorganics and their combined application in kharif have shown significant residual effect on rabi and the treatment T₇ (100% RDF + 25% N through FYM) recorded highest total carbon and total carbon stock and this was on par with the treatment T₄ i.e., 75% RDF + 25% N through FYM and T₉ i.e., 100% RDF + 12.5% N through FYM + 12.5% N through GLM, whereas significantly highest carbon sequestration potential was recorded in T₇ i.e., 100% RDF + 25% N through FYM during both the years of study at harvest stage. In rabi sorghum, the total carbon stock and carbon sequestration potential in soil increased with increase in the level of fertilizers from control (S₁) to 100% RDF (S₃) whereas total carbon in soil did not show any significant difference with increase in NPK levels from 75% RDF (S₂) to 100% RDF (S₃).
Keywords: direct and residual effect; carbon stock; carbon sequestration potential; level of fertilizers

Eco-friendly Management of Pod Borer, *Helicoverpa armigera* on Blackgram**Prerna B Chikte, Priti B Garad, G.S. Jeughale N.S Satpute***College of Agriculture, Akola, Dr. PDKV, Akola, India.***ABSTRACT**

The present research investigation entitled carried out in kharif season of 2024-25 at Seed Technology and Research Unit field, Dr. PDKV Akola. M.S 444104 Dr. PDKV Akola. Experimental plot treated with seed treatment thiamethoxam 25WG@3g/kg seed and one cover spray of thiamethoxam after initiation of sucking pests. The biorationals treatments namely *Bacillus thuringiensis* 1kg ha⁻¹, Neem oil 2%, Dashparniark 10%(125ml/10lit.), *Beauveria bassiana* 1×10⁸@40ml/ 10lit., *Metarhizium anisopliae* 1×10⁸@40ml/10lit., NSE 5%, Quinalphos 25EC 20ml/10lit. used for two spray, 1st sprat at 35th DAE and 2nd one at 50th DAE.

The mean effect of different treatments on *Helicoverpa armigera* found a lowest larval population in treatment plot T₇ (Quinalphos 25EC 20ml/10lit.) which recorded 0.14 larvae/plant. Next effective treatments shown were T₆ (NSE 5%) and T₁ (*Bacillus thuringiensis* 1kg ha⁻¹) recorded a larval population 0.44 and 0.57 larvae/plant. The effect of various biorationals on per cent pod damage of *Helicoverpa armigera*, effective treatment found was T₇ (Quinalphos 25EC 20ml/10lit.) which recorded a pod damage 3.40 per cent followed by treatments T₆ (NSE 5%) and T₁ (*Bacillus thuringiensis* 1Kgha⁻¹)

¹) recorded a damage of 7.20 and 7.40 per cent. The effect of these biorationals on population of natural enemies like Ladybird beetle and Spider found was beneficial. Highest population found in plots which treated with treatments T6 (NSE 5%), T1 (*Bacillus thuringiensis* 1kg ha⁻¹) and T2 (Neem oil 2%). Yield and incremental cost benefit ratio of various biorationals treatments tested against the pod borers of black gram indicated that highest yield of black gram was recorded in treatment T7 (Quinalphos 25EC 20ml/10lit.) was 8.80q/ha followed by treatments T6 (NSE 5%), T2 (Neem oil 2%) and T1 (*Bacillus thuringiensis* 1Kgha⁻¹) recorded yield 8.60q/ha, 7.20q/ha and 7.00q/ha. All these treatments at par with each other. The highest ICBR was obtained in treatment T7 (Quinalphos 25EC 20ml/10lit.) (1:9.61), followed by treatment T6 (NSE 5%) was (1:3.05), T1 (*Bacillus thuringiensis* 1Kgha⁻¹) ranked third with (1:2.41) ICBR.

Amongst tested biorationals against, pod borer, *Helicoverpa armigera* the most effective treatment in found was NSE 5% , followed by *Bacillus thuringiensis* and Neem oil 2% in terms of larval reduction, percent pod damage at harvest which translate in to obtaining higher yield and ICBR.

Keywords: *Biorationals; H.armigera; NSE 5%; Bacillus thuringiensis; Neem oil*

Spatial Analysis of Pesticide Persistence in Water and Water Sediment Using ArcGIS in Padre Micro-Watershed, Kasaragod District, Kerala

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ABSTRACT

In this research, the study concentrates on Pesticide residues were extracted and analyzed according to standard procedures. The standards and selected samples were qualitatively evaluated using a gas chromatograph with electron capture detector (GC-ECD) and a gas chromatograph with mass spectrometer (GC-MS). During the post-monsoon season, residual endosulfan levels remained BDL in all open wells. Alpha-Endosulfan was detected in the pre-monsoon season in two wells, OW5 and OW6, which are close to the southwest (SW) side of the study region. For the two open wells that were chosen, periodic water sampling was done from November to May during the pre-monsoon and post-monsoon seasons. Traces of pesticide were BDL from November to February. Endosulfan was found to be persistent in OW5 and OW6 from March to May. Pesticides' effects on the water in the Padre micro watershed were studied using ArcGIS. Open pond sediments located on the southwest side of the study area near Puthrakala Hill showed traces of alpha-endosulfan.

Keywords: *Pesticide; Endosulfan; ArcGIS; IDW*

Current developments in plant-based methods for the treatment of water and wastewater

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ABSTRACT

The main factors that significantly affect the amount and quality of water include urbanization, industrialization, overpopulation, the growth of agricultural operations, and the abuse of water resources. Because people release a lot of pollutants (wastewater effluents) into water bodies, fresh water sources like surface and ground water are becoming contaminated. By 2025, an estimated 3.9 billion people will not have access to clean water. Therefore, it is essential to improve water quality for a sustainable lifestyle. There are both traditional and non-conventional approaches for treating water and wastewater, and both are being utilized in various nations to raise the standard of water. Water treatment techniques include physical techniques like filtration and adsorption as well as a variety of

chemical processes like disinfection and coagulation. Traditionally, these procedures typically involve the use of a variety of chemicals, including activated alumina, silica gel, and zeolites for adsorption, alum and lime for coagulation, and chlorine and bromine for disinfection. Plant-based coagulants, adsorbents, and disinfectants are currently being extensively explored in waste or water treatment systems because these chemicals are expensive to purchase and have detrimental effects on the environment and human health. Various plants have been used to purify water due to their coagulation efficiency such as *Moringa olifera*, *Ocimum sanctum*, *Azadirachta indica*, *Cocos nucifera*, *Arachis hypogaea*, *Brassica juncea*, *Cicer arietinum*, *Oryza sativa*, *Hibiscus esculentus*, *Tamarindus indica*, etc. Different plants/ plant parts have shown the potential of water purification due to their biosorption efficacy such as *Musa paradisiaca* (peel), *Arachis hypogaea* (shells), *Azadirachta indica* (timber and leaves), *Cocos nucifera* (coir, shell, etc.), *Lantana camara* (leaves), etc. Plant-based products are sustainable alternatives to dangerous chemicals as they are less expensive, biodegradable, and environmentally friendly.

Population dynamics of major insect pests and natural enemies of sunflower in relation to weather factors

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ABSTRACT

The field experiment was conducted to study the effect of weather parameters on insect pest and their natural enemies in sunflower during rabi 2023-2024 and Kharif 2024-2025 at Oilseeds Research Unit, Dr.Panjabrao Deshmukh Krishi Vidyapeeth, Akola. The experiment was laid out in unprotected and protected regime on 100 m² plot. Twenty five plants from unprotected were selected randomly and tagged for recording observations at weekly intervals. In rabi 2023-24 Sunflower hybrids KBSH 44 was sown on 5th December, 2023. The population of leafhoppers was ranging from 3.0 to 12.3 nymphs/6L/plant, attained its peak in 4th MW having temperature 11.2 – 29.5 °C, relative humidity 36 – 85 per cent. Thrips was recorded in the range of 1.2 to 5.4 nymphs/6L/plant with peak population in 2nd MW, favoured with 11.7 – 28.6 °C and relative humidity was 49 – 86 per cent. Whiteflies was recorded in the range of 1.6 to 13.0 adults/6L/plant, peak incidence was observed in 3rd MW, the temperature range was 12.3 to 28.9°C and relative humidity was 86 per cent at morning and 43 per cent at evening. The population of *Cheilomenes sexmaculata* was noticed in the range of 0.0 to 1.8 adult/plant. Leaf hopper population shows positive significant correlation with morning relative humidity. Significant difference was noticed in between whiteflies and morning relative humidity. Significant difference was noticed in between thrips and morning relative humidity & Sunshine hours. In kharif 2024, Sunflower hybrids KBSH 44 was sown on 18th July, 2024. The population of leafhoppers was ranging from 0.0 to 13.3 nymphs/6L/plant, attained its peak in 39th MW having temperature 19.6 – 32.4°C, relative humidity 56 – 84 per cent. Thrips was recorded in the range of 0.2 to 9.2 nymphs/6L/plant with peak population in 43rd MW, favoured with 18.6 – 33.3°C and relative humidity was 53 – 85 per cent. Whiteflies was recorded in the range of 0.0 to 16.8 adults/6L/plant, peak incidence was observed in 39th MW, the temperature range was 19.6 – 32.4°C and relative humidity was 84 per cent at morning and 56 per cent at evening. Among defoliators, peak incidence of *Spodoptera litura* was noticed during 41st and 42nd MW. Head borer *Helicoverpa armigra* was observed during 42nd to 45th MW. The population of *Cheilomenes sexmaculata* was noticed in the range of 0.0 to 1.8 adult/plant and spiders was noticed in 39th to 43rd MW. Leafhopper shows positive significant correlation with minimum temperature. There was a non-significant correlation between thrips, whiteflies, *Spodoptera litura*, *H. armigra* and weather parameters.

Management of sucking pests in Sunflower

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ABSTRACT

Field experiment was conducted at Oilseeds Research Unit, Dr.Panjabrao Deshmukh Krushi Vidhyapeeth, Akola in Rabi during 2023-24. Imidacloprid 48% FS @ 5 ml/kg seed and Thiamethoxam 30FS @ 3 ml/kg seed were evaluated as seed treatment, while Foliar spray of pyriproxyfen 10EC @ 500ml/ha, pyriproxyfen 5 EC + diafenthiuron 25 SE, Thiamethoxam 12.6% + L-cyhalothrin 9.5% ZC, diafenthiuron 47% + bifenthrin 9.4 SC, Foliar spray of thiacloprid 21.7SC @ 500ml/ha, dinotefuran 20SG @ 150g/ha, diafenthiuron 50WP @ 600g/ha, Dimethoate 30EC @ 800 ml/ha and profenofos 50EC @ 1000ml/ha were tried as foliar spray, at vegetative stage of the crop. Seed treatment with Thiamethoxam 30FS @ 10 ml/kg and Seed treatment with Imidacloprid 48FS @ 8 ml/kg shows significant difference over the plots without seed treatment. Foliar spray of pyriproxyfen 10 EC @ 500 ml/ha recorded minimum population of leaf hoppers, whiteflies and thrips i.e 0.9 nymphs/6L/plant, 0.8 adults/6L/plant and 0.7 nymphs/6L/plant, respectively and also recorded maximum i.e 92.9, 93.6 and 95.8 per cent reduction in population of leafhoppers, whiteflies and thrips respectively. Coccinellids was reported slightly more untreated control treatment over chemical treatments. Higher seed yield 1553 kg/ha was recorded due to Foliar spray of Pyriproxyfen 5 EC + Diafenthiuron 25 SE @ 1000 ml/ha and Seed treatment with Thiamethoxam 30FS @ 10ml/kg; Dinotefuran 20SG @ 150g/ha. Foliar spray of Diafenthiuron 47 % + bifenthrin 9.4 SC @ 625 ml/ha having ICBR 12.35 found economical.

Urban Infrastructure Adaptation in the Face of Climate Change: A New Paradigm for Resilience
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ABSTRACT

India's urban centers are undergoing a rapid transformation marked by increased population density, economic activity, and infrastructural expansion. However, these developments are increasingly threatened by the escalating impacts of climate change. Rising average temperatures, intensified rainfall events, prolonged droughts, sea-level rise, and the emergence of urban heat islands (UHIs) are exerting significant pressure on urban infrastructure systems. This paper explores these climate-induced challenges within the specific context of Indian metropolitan areas—namely Kolkata, Ahmedabad, and Hyderabad—each representing distinct climate zones and infrastructural profiles.

Urban infrastructure in these cities, encompassing transport networks, water supply systems, and energy grids, is particularly vulnerable due to outdated designs, overcapacity usage, and lack of adaptive planning. For instance, Kolkata frequently experiences urban flooding due to inadequate drainage systems and encroachment on natural wetlands; Ahmedabad grapples with extreme heat and poor green cover that exacerbate UHI effects; and Hyderabad faces critical water shortages intensified by erratic rainfall and unsustainable groundwater extraction. These issues not only threaten the physical integrity of urban systems but also disproportionately impact marginalized populations, deepening social inequities and reducing urban livability.

To address these concerns, this study adopts a mixed-methods research design. Quantitative components include historical climate data analysis sourced from the India Meteorological Department (IMD) and IPCC regional climate models, as well as spatial vulnerability assessments conducted through GIS-based mapping. These tools help identify high-risk urban zones by overlaying environmental stressors, infrastructure typologies, and population density. The analysis is complemented by qualitative insights

derived from semi-structured interviews with twenty subject-matter experts—including civil engineers, urban planners, environmental scientists, and policy advisors—across the three focus cities.

The study reveals that existing infrastructure systems in Indian cities are not equipped to handle the changing frequency and intensity of climate events. Infrastructure performance often degrades under stress: transport systems in Kolkata are routinely disrupted during monsoons; power demand in Ahmedabad surges during heatwaves, causing load imbalances; and Hyderabad's water infrastructure fails to meet demand during dry spells, particularly in peri-urban zones. Furthermore, spatial mapping exposes pronounced climate vulnerability in low-income neighborhoods, where adaptive capacity is weakest and exposure to risk is highest.

Drawing from both empirical data and expert opinion, the paper proposes a multi-pronged framework for building climate-resilient infrastructure in Indian cities. Central to this framework is the promotion of nature-based solutions (NBS)—such as urban wetlands, bioswales, green roofs, and permeable pavements—which enhance ecological resilience while providing co-benefits such as urban cooling and flood mitigation. In Kolkata, for example, the conservation of the East Kolkata Wetlands has demonstrated significant flood buffering capacity. In Ahmedabad, city-led greening initiatives and the implementation of cool roof programs have proven effective in reducing heat stress. Hyderabad has initiated rainwater harvesting and lake rejuvenation efforts to improve water sustainability.

Another key recommendation is the decentralization of infrastructure systems, particularly for energy and water. Decentralized solar microgrids, rainwater collection systems, and localized wastewater treatment can build redundancy and flexibility into urban systems, especially in underserved areas. This approach also aligns with the principle of distributed risk management, reducing the dependence on centralized systems that are prone to failure under stress.

The research further emphasizes the need for data-driven decision-making and policy integration. GIS mapping and real-time monitoring technologies should be institutionalized to support proactive planning. Moreover, climate resilience must be embedded into urban governance frameworks, building codes, and infrastructure financing mechanisms. The current fragmentation across municipal agencies is a major obstacle; coordinated planning between departments of urban development, water resources, transportation, and disaster management is essential for long-term resilience.

Lastly, the study underscores the importance of community engagement and participatory planning. Locally informed strategies that reflect the needs and knowledge of urban residents, especially vulnerable groups, are more likely to succeed and be sustained over time.

In conclusion, this paper contributes to the growing body of research on climate-resilient urban development by offering both diagnostic insights and practical solutions tailored to the Indian context. It advocates for an interdisciplinary, equity-oriented, and forward-looking approach to infrastructure planning—one that embraces innovation while respecting ecological boundaries and socio-economic diversity. By doing so, Indian cities can transition toward infrastructure systems that are not only smart and efficient but also adaptive and resilient in the face of a changing climate.

Keywords: *Climate Change; Urban Infrastructure; Resilience; Mixed-Methods Research; GIS Mapping; Transport Systems; Water Management; Energy Systems; Nature-Based Solutions; Adaptive Housing; Decentralized Energy; Urban Planning*

Women's empowerment through the lens of social and economic empowerment**Harsha Patil***Department of Education, Kalinga University, Naya Raipur, India.***ABSTRACT**

Women empowerment stands as a cornerstone for building inclusive, equitable, and progressive societies. It takes on more relevance in the context of social and economic empowerment, addressing systemic obstacles as well as opportunities crucial to women's overall development. The process of improving women's standing in society by guaranteeing them equal rights, access to healthcare, education, and legal protection, as well as freedom from discrimination and gender-based violence, is known as social empowerment. It entails dispelling long-standing preconceptions, promoting self-worth, and empowering women to actively engage in decision-making at all societal levels.

Economic empowerment, on the other hand, gives women the means and chances to achieve financial independence, such as job access, entrepreneurship, skill development, property ownership, and income control.

In addition to helping women, economic empowerment boosts the economy of the country by increasing the work force and encouraging innovation. However, as cultural norms and societal expectations frequently limit women's participation in economic activities, economic inclusion cannot be completely realized without concurrent advancements in social empowerment. This work on social and economic empowerment are closely related ideas and that advancements in one field support those in the other. Stronger communities are shaped by empowered women, who also make a substantial contribution to better health, education, and family well-being.

As a result, programs and policies targeted at empowering women must take an integrated approach that concurrently tackles economic and social injustices. A more equitable world, gender equality, and sustainable development result from investing in both areas.

In addition to highlighting the necessity of inclusive tactics that foster significant change at the individual, community, and institutional levels, these abstract attempts to examine the mutually reinforcing relationship between social and economic empowerment in improving the position of women.

Keywords: *Social Empowerment; Economic Empowerment; Women Empowerment*

Champan Neel (Indigo): Past to Present Status**Rima Kumari¹, Pankaj Kumar², V. Shajeeda Banu¹, Vikash Kumar³, Avinash Kumar³, Randhir Kumar³ and Anil Kumar Singh³**

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ABSTRACT

The *Champan Neel* Satyagraha, led by Mahatma Gandhi in 1917, was a pivotal movement in India's struggle for independence. It began as a protest against forced indigo cultivation imposed by British colonial authorities on farmers in Champaran, Bihar. The movement marked a significant turning point in Gandhi's leadership and the Indian freedom struggle, showcasing the power of nonviolent resistance. Hence, the *Champan Neel* Satyagraha remains an important chapter in Indian history, highlighting the power of collective action and nonviolent resistance. Further, the *Champan* Satyagraha's legacy continues to inspire movements for social justice and freedom. Today, it is remembered as a significant

milestone in India's struggle for independence, with various commemorations and celebrations held to honor its centenary. The movement's impact on Indian history and its relevance to contemporary social and economic issues make it an important topic of study and reflection. To revive the cultivation of indigo in Champaran and to promote the trade, GI will be the potential tool in this aspect.

Keywords: *Champaran; Geographical Indication; Farmers; Neel; cultivation*

Climate impacts on pests, disease and management strategies

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ABSTRACT

Climate change—driven by rising temperatures, elevated atmospheric CO₂, and altered precipitation patterns—is profoundly affecting both agricultural and human health systems. Insects and microbial pathogens are expanding their geographical ranges, surviving winter more easily, and producing more generations per season, thereby elevating outbreak risks. Warming enhances vector-borne disease transmission; for example, a 1 °C rise can shift aphid emergence two weeks earlier, and a 2 °C rise can yield five extra aphid generations annually. Simultaneously, extreme events—like drought and flooding—stress crops, making them more vulnerable to pests and diseases. To mitigate these heightened risks, Integrated Pest Management (IPM) must adapt by incorporating climate-informed forecasting, diversified cropping systems, and resistant cultivars. Expanded monitoring systems, pheromones, biological controls, and precision agriculture tools are becoming essential. Agronomic practices such as crop rotation, conservation tillage, adjusted planting schedules, cultivar mixtures, and soil solarization are also effective tactics. Future research priorities include enhanced modeling tools, decision support systems, and climate-adaptive pest thresholds. Climate change is significantly impacting field agriculture by altering pest dynamics and increasing crop disease incidence. Rising temperatures and shifting precipitation patterns are expanding the range and altering the behavior of agricultural pests, leading to more frequent and severe infestations. Simultaneously, warmer and more humid conditions are promoting the spread and intensity of crop diseases, resulting in higher crop losses and reduced yields. This article examines how climate change influences pest and disease pressures—through changes in distribution, reproduction rates, and pathogen virulence—and explores implications for agricultural management. It emphasizes the essential need for integrated pest and disease management strategies, development of resistant crop varieties, and adoption of sustainable farming practices to build resilient agricultural systems in the face of climate change.

Keywords: *Climate change; Insect pests; Vectorborne disease; Elevated CO₂ Extreme weather; Integrated Pest Management (IPM); Resistant crop varieties; Cropping system diversification; Monitoring & early warning*

Adolescence to empowerment: a comparative study on emotional and social challenges among secondary school girls and their implications for gender inclusion

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ABSTRACT

Adolescence represents a formative stage for young girls, during which emotional stability and social inclusion critically shape their trajectory toward empowerment. This comparative study investigates the emotional and social challenges experienced by adolescent girls in government and private secondary schools and examines how these challenges influence their participation in gender-inclusive educational environments.

The study surveyed 200 girls across both school types using a mixed-methods approach that included standardized emotional and social adjustment inventories, interviews, and empowerment self-assessments. The findings reveal significant differences in emotional and social stressors based on school type and access to support systems. Government school girls were more prone to feelings of neglect, lack of support, and gender-based restrictions, while private school students reported higher academic expectations but had better coping mechanisms through mentorship and mental health access. Statistical analysis confirmed a significant difference ($p < 0.05$) in emotional and social adjustment scores between the two groups, affirming the alternative hypothesis. The research concludes that emotional well-being and social inclusion are vital prerequisites for effective gender empowerment. It advocates for gender-sensitive school policies, integrated life skills education, and equitable mental health access as pathways toward ensuring that adolescent girls transition from vulnerable adolescence to empowered womanhood.

Keywords: *Emotional Adjustment; Social adjustment; Inclusive educational environments*

Agroforestry as a Nature-Based Solution for Climate Resilience

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ABSTRACT

One of the greatest concerns impacting the world currently is climate change, which has severe consequences on ecosystems, agriculture, and rural lives. Land degradation, severe droughts, unpredictable rainfall patterns, and rising temperatures have been contributing to diminished agricultural productivity and increased susceptibility of smallholder farmers. Agroforestry has emerged as a potential nature-based solution for enhancing climate resilience as the need for effective and environmental friendly farming practices expands. Agroforestry increases the ecological and economic resilience of farming systems by integrating the woody perennials with agricultural crops. Trees enhance soil fertility by adding organic matter, improve water retention, reduced erosion, and modify local microclimates. From a climate mitigation perspective, agroforestry systems play a vital role to captures and stores atmospheric carbon dioxide, help in carbon sequestration and reduce greenhouse gas concentrations. At the same time, agroforestry offers adaptive benefits by diversifying income sources through the production of timber, fruits, nuts, fuelwood, and fodder. This economic diversification reduces farmers' dependence on a single crop and provides stability in times of climate-related shocks. Despite its multiple benefits, the widespread adoption of agroforestry remains limited due to challenges such as insecure land tenure, lack of technical knowledge, and inadequate policy support. To unlock the full potential of agroforestry as a nature-based solution, there is a need for integrated approaches involving supportive government policies, farmer training programs, access to finance, and inclusion in national climate action plans such as Nationally Determined Contributions (NDCs). Agroforestry offers a practical, cost-effective, and sustainable solution to climate-related challenges in agriculture. It aligns with global efforts to achieve climate resilience, food security, and ecosystem restoration, making it an essential strategy in the transition toward climate-smart and sustainable land management.

Keywords: *Agroforestry; Climate change; Carbon sequestration; Sustainable*

The Role of Soil Moisture in Regulating Carbon Sequestration and Greenhouse Gas Emissions
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ABSTRACT

This literature review explores the critical role of soil moisture in regulating carbon sequestration and greenhouse gas (GHG) emissions (CS-GHG). Soil moisture directly influences key biogeochemical processes, including photosynthesis, respiration, microbial activity, and the turnover of soil organic matter. Optimal moisture levels promote carbon storage, while extremes such as drought or waterlogging impair these processes, disrupting ecosystem carbon balance. A quantitative synthesis reveals a “peak-and-decline” trend in CO₂ emissions around 40% water-filled pore space (WFPS), whereas CH₄ and N₂O emissions peak at higher WFPS levels, approximately 60–80% and around 80%, respectively. The review also assesses how soil moisture dynamics are integrated into ecosystem models to simulate processes like microbial activity, nutrient cycling, and plant productivity. Sustainable land management practices such as conservation agriculture, agroforestry, and optimized irrigation can enhance carbon sequestration and reduce GHG emissions by maintaining favourable soil moisture conditions. The review highlights the need for improved multiscale monitoring using high-resolution remote sensing and ground-based data, as well as hybrid and feedback-driven modelling frameworks. An interactive model-experiment approach is identified as a promising pathway to refine predictive models by aligning them with empirical data. From a policy standpoint, a transition from short-term productivity goals to long-term carbon sequestration priorities is essential. This shift will require coordinated efforts across stakeholders, financial incentives, and robust monitoring systems to support sustainable land use practices that contribute meaningfully to climate mitigation.

Keywords: *carbon sequestration and greenhouse gas*

Assessing Elevational Influence on Carbon Stock Distribution Across Forest Ecosystems in The Mussoorie Forest Division

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EXTENDED SUMMARY**Purpose**

The purpose of this study is to investigate the variation in carbon content along an altitudinal gradient within the Mussoorie Forest Division of Uttarakhand, India. This region, located in the Lesser Himalayas, exhibits diverse vegetation types and ecological conditions that vary significantly with elevation. Such variations have a direct influence on biomass production, soil characteristics, and overall carbon storage potential. Given the growing global emphasis on carbon sequestration and climate change mitigation, it is essential to understand how carbon stocks are distributed across different elevations in mountainous forest ecosystems. This research aims to quantify the above-ground and below-ground biomass carbon, as well as soil organic carbon, across various elevation zones. By doing so, the study seeks to identify patterns and trends in carbon storage and to explore how altitude-related factors such as temperature, precipitation, and vegetation type contribute to these variations. The findings will provide critical baseline data for future forest management practices and carbon accounting frameworks. Furthermore, the study intends to support regional conservation planning and

contribute to national and international carbon inventory initiatives, including REDD+ (Reducing Emissions from Deforestation and Forest Degradation). By enhancing our understanding of carbon dynamics in response to altitudinal gradients, the research will offer valuable insights for policymakers, forest managers, and climate scientists working toward sustainable forest development and climate resilience in the Himalayan region.

Material and Methods

In each sampling plot, CBH readings are recorded for each individual tree of different species. With the help of CBH data DBH data of individual tree and finally mean DBH on the basis of average DBH of all individuals of a species is worked out. With the help of DBH volume of individual species in m^3 ha⁻¹ is worked out using volume equations for each species given by FSI (1996) and SFR (2005). The available volume is then converted into Bole biomass in $Mg\ ha^{-1}$ and then multiplied by BEF to get aboveground biomass. The total biomass of the forest is calculated by summing aboveground biomass, belowground biomass and dead organic matter. Finally, the carbon stock of the forest is calculated from the total biomass as per IPCC (2006).

Result

The total carbon in the forest trees of the Mussoorie forest division was 4984.93 $Mg\ ha^{-1}$. The Badrigad Range with a forest area of 4662.85 hectares and carbon content was 1493.56 $Mg\ ha^{-1}$. The Deolsari range with a forest area of 5406.00 ha. and carbon content was recorded 1934.19 $Mg\ ha^{-1}$. The Jaunpur Range with a forest area of 7442.00 hectares and carbon content was 617.20 $Mg\ ha^{-1}$. The Kempti range with a forest area of 3047.62 ha. and carbon content was recorded 838.02 $Mg\ ha^{-1}$. The Mussoorie Range with a forest area of 8900.36 ha and a carbon content was 996.06 $Mg\ ha^{-1}$. The Raipur range with a forest area of 9624.1 ha. and carbon content was recorded 449.06 $Mg\ ha^{-1}$.

Conclusion

The assessment of total carbon content across the forest ranges of the Mussoorie Forest Division reveals significant spatial variation in carbon storage, influenced by differences in forest area, vegetation density, and possibly altitudinal and ecological factors. The total carbon stock recorded across all ranges was 4984.93 $Mg\ ha^{-1}$, highlighting the substantial carbon sequestration potential of this Himalayan Forest region. These findings underscore the heterogeneous nature of carbon distribution across the Mussoorie Forest Division and emphasize the need for site-specific forest management strategies. Protecting high-carbon-density areas while restoring degraded or low-carbon zones can significantly enhance the division's overall carbon sequestration potential and contribute to climate change mitigation efforts in the region.

Keywords: *Altitudinal Gradient; Carbon stock Forest Biomass; Mussoorie Forest Division*

Community Forestry and Rural Development in Nepal (A Study of CFUGs of Palpa, Parbat and Rupandehi Districts)

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ABSTRACT

Community forestry is a forest management approach where local communities are given rights and responsibilities to manage, use, and protect forest resources sustainably. It promotes environmental conservation while improving livelihoods and empowering local people through participatory decision-making. Community forests play a crucial role in enhancing the well-being of local people through the conservation management of forests. They provide numerous benefits that improve the livelihoods of Community Forest User Groups by offering resources, employment opportunities, and ecosystem services. However, forest user groups often face challenges in management, utilization, benefit sharing, and resolving forest-related conflicts, which can hinder their effectiveness. Despite their potential,

community forests sometimes fail to address the needs of poor and marginalized people who rely on forest resources, highlighting the need for more inclusive policies and equitable benefit distribution. The results suggested that fuelwood and fodder are common forest products as more than 95% forest users collected it from all regions. But, in the case of timber, only 69% forest users collected it, indicating not using it frequently. Community forest user groups contribute to social and economic development through skill and capacity development (45%), developed as a social institution (>93%), and empowering marginalized groups (women, indigenous people and dalit) in decision making (>50%). It contributes to greenery development (87.56%) and promotes alternative energy (26.79%). However, challenges such as weak governance, elite dominance, inequitable benefit sharing, and environmental threats are hindering their effectiveness. Limited access to forest resources for marginalized communities and regulatory constraints on timber and fuelwood supply highlight the need for policy improvements.

Community Forest User Groups are widely recognized as inclusive and influential institutions in rural Nepal, contributing not only to forest management but also to local governance, social infrastructure development, and community empowerment. Despite notable successes, significant challenges persist, including inequitable resource access, limited capacity for financial and technical training, and inadequate support for alternative energy and irrigation especially affecting marginalized and remote communities.

The study concludes that community forestry has significantly contributed to rural development by enhancing natural, social, human, physical, and financial capitals. It has improved forest conditions, provided essential resources like firewood, timber, and water, and created employment and economic opportunities for local communities. Community Forest User Groups have also promoted education, inclusion, and environmental conservation, playing a crucial role in sustainable development. However, challenges such as elite dominance, unequal resource access, and limited participation of marginalized groups persist as well as three tiers governments' taxation process persist. Despite these issues, community forestry remains a powerful tool for rural upliftment and aligns with Nepal's sustainable development goals.

Community Forest User Groups have emerged as one of the most effective grassroots institutions for promoting both forest conservation and local socio-economic development. By transferring forest management rights and responsibilities to local users, the forest user groups enable communities to actively participate in the sustainable use and protection of forest resources, which in turn contributes to improved livelihoods, empowerment, and ecological restoration at the local level.

However, the effectiveness of the forest user groups is often constrained by existing social hierarchies, particularly elite dominance within the group. In many cases, influential individuals or wealthier households tend to monopolize decision-making, resource distribution, and benefit-sharing processes, leading to the exclusion of marginalized groups such as women, the poor, and indigenous communities. This imbalance not only weakens democratic participation but also undermines the equity and inclusiveness that community forestry aims to promote.

Effect of sowing dates and weed management practices on weed growth and productivity of direct-seeded rice (*Oryza sativa* L.)**Sabyasachi Bariki and Koushik Sar***Department of Agronomy, Faculty of Agricultural Sciences, SOADU, Bhubaneswar, Odisha, India.***ABSTRACT**

A field investigation was carried out during kharif, 2024 at Agriculture research station, Binjhagiri, Chatabar, Faculty of Agricultural Sciences, SOADU, Bhubaneswar. The experiment was laid out in split plot design with three replications. Treatments consisted of three sowing dates in the main plot and five weed management practices in the subplot. Results revealed that the lowest density and dry weight of all types of weeds and the maximum value of growth and yield attributes were recorded under normal sowing dates (25th June) followed by early sowing dates (10th June). Among the weed management practices, hand weeding twice 20 and 40 DAS recorded the lowest density of total weeds and maximum value of growth and yield attributes, and it was at par with pendimethalin at 1kg/ha at 3 DAS followed by 1 HW at 35 DAS. The maximum grain and straw yield were recorded with timely sown (25th June) as compared to early (10th June) and late sown (10th July) rice. Interaction effect found significant and it was indicated that timely sown (25th June) along with hoeing and weeding at 20 and 40 DAS recorded the highest grain (4707 kg/ha) and straw (5603 kg/ha) yields over others and it was at par with timely sown (25th June) along with application of pendimethalin 1 kg/ha followed by 1 HW at 35 DAS. Thus, timely sown (25th June) along with application of pendimethalin 1 kg/ha followed by 1 HW at 35 DAS appeared to be promising for effective weed management, higher productivity and profitability in direct seeded rice.

Keywords: Direct seeded rice; pendimethalin; sowing dates and weed growth

Adoption level of improved production management practices for increasing the productivity and profitability of Pusa Jawahar Hybrid Maize-1 (PJHM-1) among the tribal farmers of Madhya Pradesh**Gaurav Mahajan and R.C.Sharma***AICRP on Maize, Zonal Agricultural Research Station, J.N.K.V.V, Chhindwara, M.P., India.***ABSTRACT**

Madhya Pradesh ranks second in maize production in India, contributing 11.37% of the total output, with maize serving as a staple food in its tribal regions. Despite its high yield potential, maize cultivation faces challenges due to undulating terrain, poor soil fertility, and limited adoption of improved technologies. The low productivity is primarily attributed to the lack of high-yielding varieties and insufficient knowledge of modern cultivation practices among farmers. To address these issues, Front Line Demonstrations (FLDs) were conducted using the medium-duration hybrid variety *Pusa Jawahar Hybrid Maize-1 (PJHM-1)*. These demonstrations were organized in rainfed conditions across Barwani and Chhindwara districts from 2019–2023, covering 326 hectares and 815 farmer fields. The variety was developed jointly by JNKVV, IARI, and AICRP on Maize. Recommended agronomic practices, including organic and chemical nutrient management, proper drainage, and timely weeding, were demonstrated and compared with traditional farmer practices. Results revealed an average yield increase of 50.32% under FLDs compared to local practices. An extension gap of 21.14 q/ha and a technology gap of 3.17 q/ha indicated the potential for yield enhancement through improved practices. Economic analysis showed that an additional investment of ₹15,659/ha under FLDs yielded significantly higher returns, with an average Incremental Benefit-Cost Ratio (IBCR) of 2.18. The highest return of ₹76,210/ha were recorded in 2019–20. FLDs not only enhanced productivity and profitability but also improved farmer awareness, attitude, and skills in maize cultivation. Demonstration farmers served as role models, promoting adoption of improved practices and acting as seed sources in their communities.

Thus, FLDs proved effective in bridging the yield gap, strengthening farmer-scientist relationships, and facilitating wider dissemination of modern maize production technologies.

Sensory profile of fresh goat milk based probiotic yogurt incorporated with stevia extract and stevia powder and assessment the impact on pH and titratable acidity during storage

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ABSTRACT

Yogurt is a popular fermented product. Due to health awareness people want to reduce sugar consumption, finding the availability of suitable alternative sweeteners and the new vehicle for delivery of probiotics due to their benefits for health. Goat milk can deliver probiotics and stevia provides a sweet taste along with an alternative other calorie-dense sweeteners. So goat milk-based probiotic yogurt samples from *L. helveticus* (Probiotic culture) incorporated with stevia extract, stevia powder and different flavours (Kevda, Kesar Pista and Raspberry) reduce the gotty flavours were amalgamated. By observing the mean score of overall acceptability yogurt prepared with stevia powder and extract, Yogurt prepared with stevia extract obtained more scores compared with yogurt prepared with stevia powder; however, control obtained lower scores compared flavoured probiotic yogurt. Among all the samples highest score was obtained, in yogurt highest score was Kevda, Kesar Pista and Raspberry which was prepared with stevia extract and stored for 11 days. The pH levels varied for YS_0 , YS_1 , YS_2 and YS_3 were 4.03-4.36, 4.00-4.38, 4.01-4.37 and 3.99-4.37, respectively. The titratable acidity varies for YS_0 , YS_1 , YS_2 and YS_3 was 0.86-1.20, 0.85-1.23, 0.85-1.21 and 0.84-1.26 per cent, respectively. The significant impact of storage was observed on the yogurt samples.

Keywords: *Flavours, pH, stevia extract, stevia powder, titratable acidity and Yogurt*

Advancements in Nanomaterial-Based Sensors for Enhanced Food Safety and Quality Control”

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ABSTRACT

Ensuring food safety and quality control is essential in the food industry. So, there is a growing need for more efficient and accurate monitoring methods. Traditional detection techniques for food spoilage and adulteration are often time-consuming, expensive and require specialized expertise. Nanomaterial-based sensors become a promising alternative due to their enhanced sensitivity, selectivity and rapid response capabilities. Recent advancements have focused on the development and application of various nanomaterials, such as metal and magnetic nanoparticles, carbon nanostructures, nanowires and electrospun nanofibers. These materials exhibit unique properties that make them highly effective in detecting foodborne pathogens, toxins, pH changes and common adulterants like dyes, glucose, melamine and urea in food substances. The application of these nanosensors has demonstrated significant improvements in detecting spoilage and adulteration, contributing to more reliable food safety protocols. Furthermore, the integration of nanomaterial-based sensors into smart packaging systems represents a significant innovation in food safety and quality assurance. This approach not only enhances the ability to monitor food products in real-time but also addresses the increasing consumer demand for transparency and reliability in the food supply chain. As research in this field progresses, the use of nanotechnology in food safety is expected to expand, offering new solutions to long-standing challenges in food quality control.

Keywords: *Food safety; nanomaterials; nanotechnology; nanosensors*

AI, Drones, and Machine Learning in Agriculture: Human-Led Innovations for Climate Decarbonization in India.**Addagatla Divija, P.Madhavi***Sri Padmavati Mahila Visvavidyalayam, Tirupati, Andhra Pradesh, India.***Purpose**

The agriculture and land-use sectors in India are critical in the emission of greenhouse gasses as they contribute over 22% of the national total of greenhouse gasses emissions (The Ministry of Environment, Forest and Climate Change (MoEFCC), BUR-3, 2021). With the CO₂ levels in the atmosphere hitting 419.3 ppm in May 2024, the move to climate-resilient and low carbon systems has to happen now. This study looks at the application of new Digital Technologies, especially AI, ML, and drones to emission-guided sustainable practices and the decarbonization process of Indian landscapes. With the application of Digital Technologies, the paper aims to analyze whether such technologies can provide climate mitigation strategies for agriculture in the emission-guided sustainable practices in different regions.

Materials and Methods

The research outlined in this paper is based on formalized field-based and institutional study case methods that have been developed and hypothesized in four states in India. The first case examines methane estimated from paddy cultivation in Punjab using drones with infrared sensors. The second case describes the monitoring of forests in Assam, where a series of drone-generated images revealed an amount of degradation that was higher than was obtained via remote imagery based on satellite data. The third case examines the city of Jalgaon in Maharashtra, where it is proposed that AI based systems have been used to ensure that irrigation is optimized and not waste energy. Finally, data from Andhra Pradesh shows how ML tools are used for mapping and predicting soil carbon stocks and change. Data was extracted from the government's reporting (Ministry of Agriculture and Farmers' Welfare (MoAFW), FSI 2022), international databases (NASA MODIS, FAOWaPOR), and academic peer reviewed journal articles. The study analysis compared traditional monitoring methods with AI, drones, and ultimately compared the speed of response, accuracy, and usability policy.

Results

In the case of Punjab, the use of drones meant a delay of over 50% less in detecting methane via a drone, compared to the traditional method employed (MoAFW Pilot, 2022). In terms of the forest existing in the states bordering Assam, the addition of drone imagery increased the ability to find degraded land by 25-30 % than what could be done using satellite data alone (FSI, 2022). In the case study developed for Jalgaon, it was possible to identify that precision irrigation that was aided by AI reduced the amount of electricity consumed for irrigation by 22%, and by implication, directly reduced greenhouse gas emissions associated with this energy use (World Bank, 2022). The ML-based modelling soil carbon mapping in Andhra Pradesh achieved R² above 0.87 (Singh et al., 2023). This indicates that technology does not only improve the reliability and consistency of data but improves our ability to make decisions for carbon emission management in agriculture and land-use.

Conclusions

The application of drones, AI and ML to climate action in agriculture is already changing how emissions are measured and addressed. These tools further enabled quicker monitoring, as well as improving accuracy in carbon accounting and adapting agricultural practices to climate targets; with adequate policy support, they can consolidate their influence on India's efforts to become net-zero. A wider implementation of region-specific digital tools, along with farmer capacity development and data-sharing support through open-access platforms, could enhance India's mitigation efforts in the agriculture sector.

Keywords: *AI in Agriculture; Climate Decarbonization; Drones; Machine Learning; Carbon Monitoring; Sustainable Irrigation; Emission Reduction; MRV Systems; India*

Understanding Dynamics of Climate Change for Food & Nutritional Security**Parveen Kumar***Ag. Extension, KVK-Ramban, SKUAST-Jammu, India.***ABSTRACT**

Climate Change is now an all-pervasive phenomenon. Approximately 3.3 to 3.6 billion people live in contexts that are highly vulnerable to Climate change (IPCC synthesis report 2023). Climate Change dynamics refers to a complex interplay of various factors that cause, influence and results from changes in Earth's climate system. As a result of increased temperatures, climate extremes, increased CO₂ and other greenhouse gases (GHGs) as well as altered precipitation patterns, global food production is under severe threat (Shreshta, 2006). The estimated range depends on the intensity of future warming and the effectiveness of adaptation measures. Climate change has already resulted in decline in productivity and production of various staple crops. This ultimately hurts food and nutritional security of the population. Near about 720 million to 811 million people were undernourished in 2021, with around 200,000 people being at a catastrophic level of food insecurity. Climate change is expected to add an additional 8 to 80 million people who are at risk of hunger by 2050 (FAO, 2021). Between 2030 and 2050, climate change will further result in approximately 250, 000 additional deaths per year, from under nutrition, malaria, diarrhoea and heat stress alone. The direct damage cost to health (excluding costs in health determining sectors such as agriculture and water and sanitation) is estimated to be between US\$ 2–4 billion per year by 2030. Areas with weak health infrastructure mostly in developing countries will be the least able to cope without assistance to prepare and respond.

The State of Climate in Asia 2023 report revealed that Asia remained the world's most disaster hit region from weather climate and water related hazards in 2023. Floods and storms caused the highest no. of reported causalities and economic losses while the impact of heat waves become more severe. The report also highlighted the increasing rate of key climate change indicators such as surface temperature, glacial retreat and sea level rise which will have major repercussions for societies, economies and ecosystems in the region.

Optimizing Eri Silkworm Rearing in Nagaland: Seasonal Evaluation of Different Eco-races**Manihar Talukdar¹, Hijam Shila Devi²**

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ABSTRACT

Eri silkworm (*Philosamia ricini* Hutt.) rearing is a common practice in Nagaland's rural families. The North Eastern states of India, such as Nagaland, are a centre for Eri silkworm cultivation and offer many opportunities to generate profits in the global market. Finding the appropriate eco-race to rear out of the 26 eco-races identified in North Eastern India is essential to maximizing total returns and ensuring a stable production of silk. In this study, five most frequent eri silkworm eco-races viz., Titabar, Borduar, Barpathar, Kokrajhar and Dhemaji were reared over the summer and autumn seasons and evaluated on their rearing parameters in Medziphema, Nagaland. The Barpathar and Borduar eco-races was particularly better than the others in terms of larval measurements, growth index and effective rate of rearing (ERR) with Borduar having longer pupal duration. Correlation matrix shows pupal duration to negatively correlate with growth index and other parameters. The Titabar eco-race may be a feasible alternative to the Barpathar and Borduar eco-races, while the Dhemaji and Kokrajhar eco-races performed badly and were found unsuitable for cocoon production in these regions during both summer

and autumn seasons. The Barpathar eco-race during summer season and Borduar eco-race during autumn season showed promising rearing parameters including 5th instar larval length (7.41 ± 0.15 cm and 7.86 ± 0.09 cm), larval weight (6.98 ± 0.12 g and 7.46 ± 0.12 g), growth index (3.30 ± 0.14 % and 4.52 ± 0.13 %) and effective rate of rearing (73.00 ± 3.37 % and 88.50 ± 2.73 %) respectively. The study also indicates autumn as the optimal season for rearing eri silkworms, since most eco-races demonstrated superior rearing performance with 42.23% increase in mean growth index (by percent pupation) during the autumn season. Based on the outcomes of this study, both the Barpathar eco-race during summer and the Borduar eco-race during autumn season could be recommended to the farmers for maximum output and higher income generation.

Keywords: *Eri silkworm; Eco-race; Seasons; Rearing parameter*

Impact Of Weather Parameters on Powdery Mildew of Sunflower

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ABSTRACT

Field experiment was conducted at oilseeds Research Centre, Dr. PDKV., Akola Maharashtra in Rabi 2024. The KBSH-44 was sown in 10m x 10m plot size on 25/11/2024, 10/12/2024, 25/12/2024 and 25/01/2025. Randomly twenty plants were selected, leaving the plants from border of the plot. Observations were recorded on the top, middle and bottom leaves of fixed twenty plants from twentieth date of sowing each after four days intervals up to the maturity by recording the per cent leaf area covered by the powdery mildew leaf spot. Categorized them in to different reaction using rating scale of 0 – 9. Total eighteen observations are recorded on each different date of sowing starting from 20th day after sowing at four days interval. At first date of sowing the first incidence was recorded after 48th day and the intensity of powdery mildew was recorded in the range of 3.85 – 20.15 per cent. At second date of sowing the first incidence was recorded after 44th day and the intensity of powdery mildew was recorded in the range of 2.80 – 33.70 per cent. On third date of sowing first incidence was observed on 32nd day and intensity was in the range of 4.45-30.95 per cent. On fourth date of sowing it was in the range of 7.00-9.40 per cent.

Keywords: *sunflower; weather; KBSH44; powdery mildew*

Management Of Powdery Mildew Of Sunflower By Using New Fungicide Molecules

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ABSTRACT

The study investigates the efficacy of seed treatment with Fluxapyroxad FS @ 1.5 g/kg seed followed by foliar sprays of various fungicide combinations in managing powdery mildew diseases in sunflower conducted at Oilseeds Research Centre, Dr. PDKV., Akola Maharashtra in Rabi seasons 2024, the result shows the superior performance of azoxystrobin 18.2% + difenconazole 11.4% SC @1ml /lit in reducing disease incidence and severity, this treatment recorded the lowest incidence of powdery mildew 6.7% and 11.05% at 10 days after first and second spray respectively. Notably, the study found significant differences in yield components across treatments, the highest yields were recorded in the treatment combining Fluxapyroxad seed treatment with azoxystrobin 18.2% + difenconazole 11.4% SC @1ml /lit foliar spray, achieving yields of 1557 kg/h. These results indicate that integrated disease management using these fungicide combinations can effectively control powdery mildew diseases in sunflower.

Keywords: *sunflower; Rabi; powdery mildew; fungicide*

Influence Of Weather Parameters on Alternariaster Leaf Spot of Sunflower**Manjusha S. Gaikwad¹, Manisha Deshmukh², Madhuri Dhomne³, Devyani Nemade⁴, Vandana Mohod⁵**¹*Oilseeds Research Centre, Dr. PDKV., Akola Maharashtra, India.*²*Department of Floriculture, Dr. PDKV., Akola Maharashtra, India.*³*Pulses Research Unit, Dr. PDKV., Akola, Maharashtra, India.*⁴*College of Agriculture, Dr. PDKV., Akola Maharashtra, India.*⁵*AICRP on Post Harvest Technology, College of Agriculture Technology, Dr. PDKV., Akola, Maharashtra, India.***ABSTRACT**

Field experiment was conducted at Oilseeds Research Centre, Dr. PDKV., Akola, Maharashtra in kharif 2024. The KBSH-44 was sown in 10m x 10m plot size on 10/08/24, 25/08/2024, 10/09/2024 and 25/09/2024. Randomly twenty plants were selected, leaving the plants from border of the plot. Observations were recorded on the top, middle and bottom leaves of fixed twenty plants from twentieth date of sowing each after four days intervals up to the maturity by recording the per cent leaf area covered by the Alternariaster leaf spot. Total eighteen observations are recorded on each different date of sowing starting from 20th day after sowing at four days interval. At first date of sowing the first incidence was recorded after 52nd day and the intensity of Alternariaster leaf spot was recorded in the range of 5.56-10.93 per cent. On second day of sowing first incidence was observed on 44th day and intensity was in the range of 4.40-15.51 per cent. On third date of sowing it was in the range of 2.55-36.50 percent and on fourth date of sowing in the range of 1.95-18.75 per cent.

Keywords: *Weather; sunflower; Alternariaster; KBSH 44***Management Of Sclerotium Rot/Collar Rot of Summer Groundnut****Manjusha S. Gaikwad¹, P. N. Mane¹, Manisha Deshmikh², Vandana Mohod³, Devyani Nemade⁴, Archana Thorat⁵**¹*Oilseeds Research Centre, Dr. PDKV., Akola, Maharashtra, India.*²*Department of Floriculture, Dr. PDKV., Akola Maharashtra, India.*³*AICRP on Post Harvest Technology, College of Agriculture Technology, Dr. PDKV., Akola, Maharashtra, India.*⁴*College of Agriculture, Dr. PDKV., Akola, Maharashtra, India.*⁵*Pulses research Unit, Dr. PDKV., Akola, India.***ABSTRACT**

At selected location in kharif 2024, the soybean crop will be grown by following the recommended agronomical practices. In the summer the land preparation will be done by using three agronomical practices and methods as main treatment i.e. by using cultivator followed by rotavator, by using cultivator followed by collection of stubbles of previous crop followed by rotavator and by using plough followed by rotavator. Field experiment was conducted in summer 2024. The TAG-73 was sown in 30 x 10cm spacing, with five treatment having twelve lines in each treatment including control. Three replications with three block in each replication. Percent plant affected due to Sclerotium rot and Collar rot was recorded in each plot. The observations on yield recorded on net plot basis/ per hector basis and ICBR calculated. Seed treatment with Prochloraz 5.7% +Tebuconazole 1.4% w/w ES 0.3 ml/kg followed by Pseudomonas fluorescens (cfu10⁸) @ 10 g/kg seed + soil application @ 5 kg/ha fortified with FYM at the time of sowing recorded minimum 3.78 and 0.78 per cent incidence of sclerotium rot and collar rot respectively followed by Seed treatment with Prochloraz 5.7% +Tebuconazole 1.4% w/w

ES @ 0.3 ml/kg followed by *Trichoderma asperellum* (cfu 10⁷) @ 10 g/kg seed + soil application @ 5kg /ha fortified with FYM at the time of sowing i.e. 7.33 and 1.00 per cent incidence of sclerotium rot and collar rot respectively.

Keywords: *sclerotium rot; collar rot; Summer groundnut; Trichoderma*

Testing of beneficial microbes isolated from safflower rhizosphere for various biochemical reaction

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ABSTRACT

Soil from rhizospheric area of safflower was used for isolation of beneficial microbes for N fixing, P solubilizing and K mobilizing microorganisms by using different specific media i.e. Ashbys medium for *Azotobacter*, Pikovaskaya medium for PSB, Aleksandrov agar medium for K solubilizing bacteria. Various biochemical tests viz. KOH, H₂S, Arginine, Urease, Oxidase, Citrate utilization, Starch hydrolysis, Phosphate solubilization, Potash solubilization, Catalase, Gelatin liquefaction, Casein hydrolysis were carried out on selected isolates. Beneficial microbes for N fixing, P solubilizing and K mobilizing by using different specific media i.e. Ashbys medium for *Azotobacter*, Pikovaskaya medium for PSB, Aleksandrov agar medium for K mobilizing bacteria were isolated from rhizospheric soil of safflower. Biochemical test were carried out for KOH, H₂S, Arginine, Urease, Oxidase, Citrate, Starch, Phosphate, Potash, Catalase, Gelatine liquification and Casein production. . Not all the isolates recorded positive reaction against all the test, but almost all test recorded positive reaction for Oxidase, Citrate and Starch solubilization.

Keywords: *Beneficial; Root nodules; Azotobacter; PSB; KSM*

Biochemical Analysis of Beneficial Microbes Isolated From Ground Nut Root Nodules

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ABSTRACT

The investigation was carried out to study the association of rhizospheric beneficial microbes in ground nut crop. Root nodules and rhizospheric soil of ground nut was used for isolation of beneficial microbes for N fixing, P solubilizing and K mobilizing microorganisms by using different specific media i.e. Pikovaskaya medium for PSB, YEMA medium for *Rhizobium*, Aleksandrov agar medium for K solubilizing bacteria. Various biochemical tests viz. KOH, H₂S, Arginine, Urease, Oxidase, Citrate utilization, Starch hydrolysis, Phosphate solubilization, Potash solubilization, Catalase, Gelatin liquefaction, Casein hydrolysis were carried out on selected isolates. Beneficial microbes for N fixing, P solubilizing and K mobilizing by using different specific media i.e. Pikovaskaya medium for PSB, YEMA medium for *Rhizobium*, Aleksandrov agar medium for K mobilizing bacteria were isolated from root nodules of ground nut. Biochemical test were carried out for KOH, H₂S, Arginine, Urease, Oxidase, Citrate, Starch, Phosphate, Potash, Catalase, Gelatine liquification and Casein production. Not all the isolates recorded positive reaction against all the test, but almost all test recorded positive reaction for Oxidase, Citrate and Starch solubilization.

Keywords: *Beneficial; Root nodules; Rhizobium; PSB; KSM*

Deforestation in Forest Divisions of Bhabar Region in Nainital District of Uttarakhand, India
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ABSTRACT

Nainital district of Uttarakhand is made up of some hilly region and the rest is Bhabar region (plains and foothills). The forest type in Nainital is subtropical, temperate and sub-alpine, due to variation in altitude. The forests of Nainital also appear to be affected by deforestation at this time. According to Global Forest Watch report 2022, in 2020, the natural forest of Nainital was spread over 170Kha, but by 2022, 450ha of its area has been lost. Jim Corbett National Park is a protected area, apart from this, deforestation is seen in the reserve forest divisions i.e., Ramnagar Forest Division, Tarai-West Forest Division Ramnagar, Tarai-Central Forest Division Rudrapur, Haldwani Forest Division and Tarai-East Forest Division Haldwani. In these forest divisions, mainly tree species like Sal, Sisham, Haldu, Semal, Rohini, Khair, Amaltas, Bel, Arjun, Saugon and Eucalyptus etc. are found. Plantation of Saugon and Eucalyptus trees is done in the reserve forest which has economic importance. But deforestation is more prevalent in these plantations. The main causes of deforestation are forest fire, road construction, powerline transmission, illegal tree cutting and soil collection etc. For plantation, only one type of tree species is cultivated in particular area, due to which mixed forests are decreasing. For Saugon and Eucalyptus plantation, a certain gap is kept between the plants so that the gap between the remains empty. Apiculture activities are also going on in some places in the forests and vegetation is being damaged in those places too. Sometimes, when mistakes are made in controlled burning, green trees get scorched and are unable to survive further. The tree canopy of plantation is lower than that of mixed tree forest (dense) canopy due to which some moist type vegetation and vines are unable to survive beneath it. Therefore, plantation can also be a major reason for the increasing deforestation in future.

Keywords: *Bhabar region; Saugon; Eucalyptus; Apiculture; Tree canopy*

Zero-tillage in Wheat Productivity of Black gram-Wheat Cropping System at Bundelkhand Agro-climatic zone

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Krishi Vigyan Kendra, Tikamgarh, M.P., India.

ABSTRACT

There is an urgent need to match food production with increasing world population through identification of sustainable land management strategies. However, the struggle to achieve food security should be carried out keeping in mind the soil where the crops are grown and the environment in which the living things survive. Conservation agriculture (CA), practicing agriculture in such a way so as to cause minimum damage to the environment is being advocated at a large scale world-wide. Conservation tillage, the most important aspect of CA, is thought to take care of the soil health, plant growth and the environment. This work done on zero-tillage to understand its impact from the perspectives of the soil, the crop and the Bundelkhand Agro-climatic Zone conditions. Processes of climate change mitigation and adaptation found zero tillage (ZT) to be the most environmental friendly among different tillage techniques. Therefore, conservation tillage involving ZT and minimum tillage which has potential to break the surface compact zone in soil with reduced soil disturbance offers to lead to a better soil environment and crop yield with minimal impact on the environment. A comparison between zero tilled and conventionally tilled in wheat indicated that cost of cultivation was Rs. 9335/ha in zero tillage less than check plot. While in check it was higher Rs. 19934/ha. The zero tillage saved entire Rs. 10599/ha as cost thus reducing the cost. Besides this, the average irrigation requirement in zero tillage was less 4.53 (unit) as against 5.11 (unit). It may be concluded that adoption of zero tillage

saved the water in the Bundelkhand might be in practices. Adopter reported a saving of 30.2% human labour and 35.11% mechanical labour in zero tillage. Reducing the seed rate from 10-20 kg/ha in zero tillage was observed. More and thick strong tilling in zero tillage and less use of fertilizers which avoiding losses due to leaching, volatilizing and run off of fertilizers in conventional method. The grain yield in demonstration of zero-tillage was recorded an average of 2.94 tones/ha while in check plots the grain yield was higher and it was an average in 4.2 tones/ha. The straw yield was average 4.7 tones in zero-tillage and 6.8 tones/ha in conversational farmer practices. Total grass return was found in zero-tillage Rs.63945/ha and in conventional it was Rs. 93090/ha. The higher net returns Rs.74656/ha in conventional tillage and less net return was obtain in zero-tillage Rs. 54610/ha. The results showed that grain yield and net return were higher in conventional method while the cost of cultivation was too higher in conventional tillage. But the average benefit cost ratio 5.8 was greater in zero-tillage than 4.0 conventional tillage practices of the local farmers. Hence, zero tillage in wheat cultivation was also showing the considerable amount of profit, besides promoting the conservation of the precious resources. Zero tillage wheat requires lesser amount of critical inputs, which constitutes more than 40% of the total cost. Zero tillage may lead to soil compaction and thereby cause damage to soil fertility in the long run. Government should undertake proactive initiatives to provide the implement on hiring basis or form self-help groups which could be manage these at village or Panchayat level, so that the small and marginal farmers could also get benefit of improved cultivation practices. Zero tillage reduces water requirement of crop and the loss of organic carbon by oxidation. Zero tillage reduces Phalaris minor problem in wheat. The carbon status of soil was significantly enhanced in surface soil.

Climatic Resilient Varieties in bio-stress management in Black gram suitable at Bundelkhand Agro-climatic zone during

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ABSTRACT

The problems were identified heavy infestation of MYMV disease in local and old varieties and T-9 is released variety of 1972 which farmers were cultivate that are susceptible to viral diseases which are triggered by insect vectors under drought like situations. The productivity of these local cultivars is low and often crop failures are experienced either due to rainfall extremes or disease occurrence. Improved high yielding biotic stress resistant variety along with proper management practices are to be introduced and promoted so as to improve the resilience of farming in the drought prone areas. For this purposes the intervention taken by KVK, Tikamgarh under NICRA project, the promotion of bio-stress resistant varieties in this connection there were black gram crop variety IPU 94-1/PU-1 were taken for demonstration in NICRA adoptive village farmers. The climatic vulnerability of this zone are as early season drought (delayed onset), Normal onset followed by 15-20 days dry spell, Mid-season drought (long dry spell, consecutive 2 weeks rainless, Terminal drought, Insufficient groundwater recharge due to low rainfall/ over-exploitation, Scarcity of feed and fodder and water for animals during drought, Feeding/ reproductive management of livestock during heat/ cold wave. The resilient practices and technology for the management of MYMV was selected the resistant Blackgram variety IPU 94-1 which is resistant against the MYMV. The characteristics of Technology as the released year in 1999 from IIPR Kanpur, Resistant to MYMV, average yield 12q/ha maturity days (85). The PU-1 was also screened in stress and normal years. The technologies were screen out among the farmers for the 2010-11 to 2021 (10 years). The results indicating from last 8 years of demonstration under crop production module that the Black gram variety IPU 94-1 was resistant against the MYMV but it was found 10 days late in maturity than local & old variety T-9 which is susceptible to MYMV. The result from Tables indicating that IPU 94-1/PU-1 was giving more yield about 2 q/ha than T-9 and money saving Rs/ha was 40888. However, the reduction in biotic stress (MYMV %) was 88.88%. As the drought and low

rainfall years the Black gram crop is also low water requirement and short duration crop which is also found tolerate to dry spell occurred during cropping season while in the situation of early withdrawal monsoon at the time of September the performance of IPU 94-1 was superior to other long duration varieties of black gram. The other benefits of technology are as short duration - Suitable during late monsoon (abiotic stress), saving of plant protection expenses & environment pollution, Increase fertility through - N-Fixation in soil, Seed replacement ration extended in area and low water requirement than soybean. The demonstrations resulted that during both the years as stress and normal, the performed of variety was better than local ones. MYMV resistant black gram varieties IPU-94-1/PU-1 have been widely adopted in about 35000 ha in Tikamgarh, Madhya Pradesh as an outcome of the varietal performance in NICRA village. MYMV resistant varieties of pulse need to be included in the seed supply chain for making them available. Tikamgarh become seed supplier hub of black gram varieties to other districts due to increased no. of seed societies. Black gram varieties popularized under NICRA from 2011 extended in district as 1.0 lac ha and become first major crop before it was soybean now third and groundnut second in place.

Climatic stress Management Technologies for Kharif Crops under Farming System Typologies at Bundelkhand Agro-Climatic Zone

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ABSTRACT

The FLDs (Front-line Demonstrations) conducted in NICRA village on FSTs (Farming System Typologies) of Kharif crops production with or without animal under rainfed conditions at village-Kodiya of district-Tikamgarh. The district is situated under Bundelkhand Agro-climatic zone of Madhya Pradesh. The demonstrations were carried out for two years 2022-23 and 2023-24 in Kharif season. The climate change in Bundelkhand Agro-climatic zone has potential influence on various aspects of agriculture and allied sectors. Some key aspects of climate change are change in temperature, rainfall, extreme weather events like dry spells and intensive rains. Changes in temperature and rainfall patterns can affect crop yields and the timing of agricultural activities. Increased frequency of extreme weather events can result in crop damage and economic losses for farmers. The possible impacts of climate change, like change in cropping patterns, hampering of crop productivity, carbon released, losses of irrigation water and in-situ moisture, increased in cost of cultivation as well as increased labours, inputs, cost of productions, pests and insect attack may threaten the agro-biodiversity and food security of the district. Climate change has hit the agriculture-based livelihoods and food grain production in the Bundelkhand district has decreased by 58%, it is very serious for the agriculture-based society and economy. The FST-1 and FST-2 of rainfed conditions affected with climatic abiotic and biotic stress of climate change but the interventions taken up with resilient technologies and practices were found effectively in mitigations of these adverse effect of climatic stress during kharif seasons of the two years 2022-23 and 2023-24. The maximum productivity, net return and B:C ratio were recorded in soybean, black gram, ground nut and sesame with both FSTs in NICRA village compared to non-NICRA. Reduction in cost of cultivations due to use of RDF fertilizers, BBF machine, seed rate were found in FSTs technologies demonstrations while in non-NICRA village these inputs and cost of cultivations were greater than NICRA village. The indiscriminate used of inputs leading to release of excess nitrogen which decreased the soil microbial activities and increased mineralization of elemental nitrogen, reduction in soil moisture, nitrogen immobilization, reduction in C:N ratio, reduced mineral action and Lack of use of potash increased susceptibility to biotic and abiotic stress to plants.. The crops cultivations with animals provided as animals wastes those were used as manures and natural resources

management leading to decompositions of carbon into soil as carbon sequential. leading to susceptibility in the plants to biotic and abiotic stress.

Invisible Burdens, Unequal Resilience: A Feminist Political Ecology of Male Migration and Women's Agency in Flood-Prone Supaul, Bihar

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ABSTRACT

Climate change is driving profound socio-economic transformations in rural India, particularly in ecologically vulnerable states such as Bihar. Supaul, one of the most flood-prone districts along the Kosi River, is witnessing climate-induced male migration as a key coping strategy in response to agricultural crises and food insecurity. The adaptation burden, however, falls disproportionately on women left behind, who must navigate intertwined productive, reproductive, and community roles with limited systemic support. Drawing on Feminist Political Ecology (FPE) and Climate Justice frameworks, this study examines how caste, class, and landlessness shape women's lived experiences under climate stress in Supaul. Based on field interviews with 50 women, district-level surveys, and secondary data, the study finds that although women play crucial roles in rural survival, they face systemic exclusion from land ownership, access to credit, and formal governance structures. The paper advocates for proactive, gender-sensitive institutional planning to embed women-centered adaptive resilience within Bihar's climate adaptation policies.

Keywords: *climate change; gendered migration; feminist political ecology; climate justice; Bihar*

Evaluating the efficiency of Lahore Smog Tower using ArcGIS and analyzing the relationship of Lahore AQI with precipitation

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EXTENDED SUMMARY

Introduction

This study assesses the effectiveness of smog mitigation technologies and explores the relationship between rainfall and air quality in Lahore, Pakistan, using geospatial techniques. Lahore, frequently ranked among the most polluted cities globally, suffers from severe smog episodes driven by vehicular emissions, industrial activity, and seasonal crop residue burning.

Objectives

As a technological response, a Smog Cutting Tower (SCT) was installed at Mehmood Booti by RAPIDEV Pvt. Ltd. in collaboration with the Environmental Protection Agency (EPA) Punjab. This research evaluates the operational efficiency of the SCT through comparative analysis of Air Quality Index (AQI) data collected before and after its installation at various distances.

Methods

Simultaneously, the study analyzes the correlation between rainfall and AQI levels in Lahore for the years 2022 to 2024, using CHIRPS satellite precipitation data obtained via ClimateEngine.org and AQI data from EPA sources. GIS tools, including ArcGIS, were employed to spatially map pollution trends, although interpolation-based hotspot mapping remains pending due to incomplete data.

Results

The findings indicate no significant or localized reduction in AQI attributable to the SCT, and physical evidence of particulate matter removal was inconclusive. Results show a moderate but consistent

inverse relationship between precipitation and AQI, with p-values narrowly missing statistical significance thresholds, highlighting rainfall's natural air-cleansing effect.

Conclusion

The study concludes that natural meteorological processes play a more pronounced role in short-term air quality improvement than current technological interventions, emphasizing the need for robust, data-driven, and multi-faceted approaches to urban air pollution management. This research provides valuable insights for urban policymakers to prioritize nature-based solutions over unverified technologies.

Research And Development For Climate Action

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ABSTRACT

Climate change poses one of the most urgent and complex challenges of the 21st century, necessitating swift, science-based, and innovation-driven responses. Research and Development (R&D) plays a foundational role in climate action by generating new knowledge, advancing technological innovations, and informing effective policy frameworks for both mitigation and adaptation. A comprehensive analysis of the evolving role of R&D in addressing climate change, emphasizing the need for interdisciplinary collaboration, inclusive innovation, and scalable solutions.

Key dimensions explored include:

Climate Science and Modeling: Advancements in atmospheric research, earth system modeling, and real-time monitoring that improve our understanding of climate dynamics and future risk scenarios.

Technology Innovation for Mitigation: Development of low-carbon technologies such as renewable energy systems (solar, wind, bioenergy), carbon capture and storage (CCS), energy-efficient systems, and low-emission transport networks.

Adaptation Research: Innovations supporting climate-resilient agriculture, sustainable water resource management, urban planning, and ecosystem-based approaches to increase resilience in vulnerable communities.

Digital Technologies: Utilization of Artificial Intelligence (AI), Internet of Things (IoT), Geographic Information Systems (GIS), and big data analytics to enhance climate forecasting, early warning systems, and decision-making tools.

Socio-economic and Policy Research: Focus on behavioral, economic, and institutional studies to support equitable transitions, community-based adaptation, and climate finance mechanisms.

Drawing from global and national case studies, the presentation highlights successful applications of R&D—from drought-resistant crop varieties and smart grids to climate services for farmers and predictive analytics for disaster risk reduction. It also addresses critical challenges such as fragmented research agendas, insufficient funding, and limited cross-sectoral coordination. The discussion concludes with a strong call for increased investment in R&D, greater public-private partnerships, and strengthened international cooperation to drive innovation ecosystems that align with the Paris Agreement and the Sustainable Development Goals (SDGs). Emphasis is placed on the democratization of knowledge, open data platforms, and capacity-building as essential enablers of a climate-resilient and sustainable future.

Keywords: Climate action, research and development, innovation, mitigation, adaptation, climate resilience, sustainable technologies, interdisciplinary research, climate policy

Pandemics, Climate Change, and Agriculture: Strategies for Safeguarding Mental Well-Being
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ABSTRACT

Global crises, such as pandemics and climate change, present significant challenges that impact mental well-being worldwide. The COVID-19 pandemic has notably increased anxiety, depression, social isolation, and economic instability, resulting in a substantial rise in mental health disorders, particularly among healthcare workers, vulnerable communities, and rural agricultural populations that rely on farming (WHO, 2022; Skalski et al., 2022). To address these challenges, it is important to recognize that factors like intolerance of uncertainty and diminished social support can intensify distress. However, fostering resilience and promoting adaptive coping strategies can provide essential protection during prolonged periods of stress. Climate change further complicates mental health issues through a variety of channels. Direct exposure to climate-related disasters such as floods, droughts, and heat-waves can disrupt agricultural productivity, resulting in economic losses, food insecurity, and displacement. These stressors are significant contributors to heightened psychological distress, post-traumatic stress disorder (PTSD), anxiety, and depression in farming communities (Lawrance et al., 2021; Indian Psychiatric Society, 2025). In addition, persistent environmental degradation can lead to eco-anxiety and eco-grief among farmers who face threats to their traditional ways of life. This evolving landscape creates a sense of uncertainty and helplessness (WHO, 2021; JAMA, 2024). It is also concerning that rising temperatures have been linked to higher suicide rates among agricultural workers, highlighting the urgent need to address the mental health risks associated with climate-induced stressors in this industry (JAMA, 2024). Amidst these challenges, it is crucial to implement integrated public health and agricultural policies that enhance resilience, promote effective coping strategies, and strengthen social support networks within communities. Addressing the mental health impacts of climate change alongside these public health initiatives will also be vital in mitigating the cumulative effects on vulnerable populations. Ensuring timely access to mental health resources and agricultural extension services can support communities in navigating both the immediate and long-term challenges posed by climate change (Skalski et al., 2022; Lawrance et al., 2021). By incorporating mental health considerations into climate adaptation and food security frameworks, we can better support the well-being and livelihoods of agricultural populations as they face current and future global challenges.

Keywords: *Climate change; Pandemic; Mental Health; Agriculture*

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Floriculture: “A Blossoming Path for Rural Income Diversification”

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ABSTRACT

Floriculture, the cultivation of ornamental and flowering plants, has emerged as a high-value sector within horticulture, offering promising avenues for enhancing farmer incomes and improving the livelihood security. One of the primary strategies to boost rural income through floriculture is crop diversification. With a rising demand for flowers in daily life for decoration, rituals, personal gifting, landscaping, and events. Flower farming offers higher economic returns compared to many traditional agricultural crops. This makes floriculture an attractive livelihood option for small and marginal farmers seeking alternatives to conventional farming. One of the major advantages of floriculture is its short crop cycle and year-round production potential, which allows farmers to generate regular income. Flowers like marigold, rose, chrysanthemum, tuberose, and gladiolus are widely cultivated due to their adaptability and steady market demand. Floriculture also requires relatively small landholdings, making it ideal for rural households with limited resources. In addition to fresh flower production, value addition activities such as making garlands, floral bouquets, dried flower crafts, and essential oil extraction from aromatic flowers further helps in enhancing the income of farming community. These small-scale, home-based enterprises create opportunities for women and youth engagement, thus contributing to inclusive rural development. Nursery management is yet another important income-generating aspect of floriculture. Selling potted ornamental plants, saplings, and decorative foliage caters to the growing trend of home gardening and urban landscaping. The increasing interest in indoor plants and eco-friendly décor items also opens niche markets for rural entrepreneurs. Moreover, protected cultivation using polyhouses or shade nets ensures high-quality produce and consistent yields, making floriculture less dependent on seasonal and climatic variations. With proper post-harvest handling and market linkages, farmers can reduce losses and gain access to profitable urban and regional markets. Therefore, floriculture offers a viable pathway for rural income diversification by combining aesthetic appeal with economic value. Its adaptability, profitability, and employment potential make it a key driver of sustainable rural livelihoods.

Keywords: *Diversification; Floriculture; Income generation; Nursery; Rural development; Value addition*

Correlation-Driven Trends in Yearly Air Pollution and Meteorology: A Case Study of Delhi (2024)**Priya Dwivedi^{1,2}, Radhakrishnan S.R.^{1,2}, Himanshu Shekhar³, and Deepak kumar³**¹*Environmental Sciences and Biomedical Metrology Division, CSIR-National Physical Laboratory, New Delhi, India.*²*Academy of Scientific and Innovative Research (AcSIR), Ghaziabad, India.*³*Air Lab, Central Pollution Control Board (CPCB), Delhi, India.***ABSTRACT**

This study investigates the trends of key air pollutants (PM_{2.5}, SO₂, CO, NH₃, and ozone) in Delhi during 2024 and their correlations with meteorological parameters such as temperature, solar radiation, and wind speed. Data from three Continuous Ambient Air Quality Monitoring Stations (CAAQMS) were analyzed using Pearson's correlation and seasonal aggregation. The findings reveal significant seasonal variations, with winter showing the highest pollutant levels due to meteorological stagnation. Correlation analysis highlighted strong relationships between pollutants, such as NH₃ and SO₂ ($r \approx 0.77$) and ozone and temperature ($r \approx 0.40$), indicating photochemical activity. Seasonal heatmaps were used to illustrate the influence of meteorological factors on pollutant behavior. This study emphasizes the need for seasonal air quality management strategies that incorporate meteorological forecasting to improve pollution control efforts.

Keywords: *Air pollution; Meteorology; Seasonal variation; Correlation; PM_{2.5}; Ozone; Delhi***Research and development for climate action****Sarjeet Yadav, Laxmi Meena***Department of Extension Education, Rajasthan College of Agriculture, Udaipur, Rajasthan, India.***ABSTRACT**

Climate change poses one of the most urgent and complex challenges of the 21st century, necessitating swift, science-based, and innovation-driven responses. Research and Development (R&D) plays a foundational role in climate action by generating new knowledge, advancing technological innovations, and informing effective policy frameworks for both mitigation and adaptation. A comprehensive analysis of the evolving role of R&D in addressing climate change, emphasizing the need for interdisciplinary collaboration, inclusive innovation, and scalable solutions.

Key dimensions explored include:

Climate Science and Modeling: Advancements in atmospheric research, earth system modeling, and real-time monitoring that improve our understanding of climate dynamics and future risk scenarios.**Technology Innovation for Mitigation:** Development of low-carbon technologies such as renewable energy systems (solar, wind, bioenergy), carbon capture and storage (CCS), energy-efficient systems, and low-emission transport networks.**Adaptation Research:** Innovations supporting climate-resilient agriculture, sustainable water resource management, urban planning, and ecosystem-based approaches to increase resilience in vulnerable communities.**Digital Technologies:** Utilization of Artificial Intelligence (AI), Internet of Things (IoT), Geographic Information Systems (GIS), and big data analytics to enhance climate forecasting, early warning systems, and decision-making tools.**Socio-economic and Policy Research:** Focus on behavioral, economic, and institutional studies to support equitable transitions, community-based adaptation, and climate finance mechanisms.

Drawing from global and national case studies, the presentation highlights successful applications of R&D—from drought-resistant crop varieties and smart grids to climate services for farmers and predictive analytics for disaster risk reduction. It also addresses critical challenges such as fragmented

research agendas, insufficient funding, and limited cross-sectoral coordination. The discussion concludes with a strong call for increased investment in R&D, greater public-private partnerships, and strengthened international cooperation to drive innovation ecosystems that align with the Paris Agreement and the Sustainable Development Goals (SDGs). Emphasis is placed on the democratization of knowledge, open data platforms, and capacity-building as essential enablers of a climate-resilient and sustainable future.

Keywords: *Climate action; research and development; innovation; mitigation; adaptation; climate resilience; sustainable technologies; interdisciplinary research; climate policy*

Empowering Startups through Entrepreneurial Finance and Investment Strategies

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ABSTRACT

This dissertation investigates the role of specific entrepreneurial finance and investment strategies in empowering startups to achieve sustainable growth, with a particular focus on addressing the critical issue of limited access to funding and resources during the initial phases of business development. Through a mixed-methods approach, qualitative data were collected from interviews with startup founders, complemented by quantitative analyses of financial performance metrics across various startups. The research reveals that tailored financial strategies, including targeted micro-investments and collaborative funding mechanisms, significantly improve startups resilience and growth trajectories. Notably, the findings highlight that startups implementing these strategies not only report superior financial outcomes but also demonstrate enhanced capacity for innovation, which is particularly salient in the healthcare sector. The implications of this study suggest that fostering a conducive funding environment and promoting innovative investment strategies can catalyze the emergence of sustainable healthcare startups, thereby enhancing the overall efficiency and effectiveness of healthcare delivery. By equipping startups with the financial tools and knowledge necessary for growth, this research contributes to a greater understanding of how strategic finance can transform entrepreneurial ventures within the healthcare landscape, ultimately leading to improved patient outcomes and systemic advancements in health service delivery.

Keywords: *Entrepreneurial Finance; Startup Growth Strategies; Healthcare Innovation*

Application of It And Digital Tools In Climate Studies

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ABSTRACT

The integration of Information Technology (IT) and digital tools has significantly advanced the field of climate studies, enabling more precise monitoring, modeling, and management of climate change impacts. Emerging technologies such as satellite-based remote sensing, Geographic Information Systems (GIS), Artificial Intelligence (AI), Machine Learning (ML), Internet of Things (IoT), and big data analytics are revolutionizing how climate data is collected, analyzed, and visualized in real time. These tools have enhanced our understanding of climate patterns, enabled accurate forecasting of extreme weather events, and facilitated proactive adaptation and mitigation planning. By exploring the diverse and innovative applications of IT in climate research and decision-making. It highlights the role of remote sensing and GIS in mapping land-use change, glacial retreat, deforestation, and sea-level rise. It also examines the use of AI and big data analytics in climate modeling, risk assessment, and the development of early warning systems. Additionally, mobile applications, cloud computing platforms, and open-access data portals are discussed for their role in democratizing climate information and

improving communication among scientists, policymakers, farmers, and disaster management authorities. Some recent case studies will illustrate how these digital tools support interdisciplinary collaboration, enhance predictive capabilities, and contribute to more effective, evidence-based environmental governance. The presentation concludes by emphasizing the critical need for digital literacy, data integration, and inclusive policies to harness the full potential of IT in climate resilience and sustainability efforts.

Keywords: *Climate studies; digital tools; remote sensing; GIS; AI; big data; early warning systems; climate resilience; climate adaptation; decision support*

Indian women and climate Change: Agents of resilience in a warming economy

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ABSTRACT

Climate change presents a significant threat to India's social and ecological systems which are increasingly witnessing higher temperatures, erratic monsoons, water stress and disruptions to livelihood options. Indian women in this context — especially those in rural, indigenous and vulnerable areas — on the one hand, are most 'at risk' and on the other, exposed to the least acknowledged and heard stories of 'adaptation'. They suffer on a daily basis from the effects of food shortages, resource exhaustion, and displacement, yet their responses tend to be shaped on traditional wisdom, and on their sense of shared identity and perseverance.

This paper looks at the way Indian women are not mere bystanders at the receiving end of climate change, but also active stewards of environmental resilience. Whether it is introducing water conservation technologies or sustainable agricultural practices or piloting community-based adaptation programs, their work is invaluable.

Keywords: *Indian women; Climate Change; Gender; climate justice*

Metagenomic Techniques for Identifying Plant Disease

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ABSTRACT

Plant diseases pose a severe threat to global food security, with an estimated 20-40% annual crop production loss. Accurate, rapid, and thorough diagnostics are critical to sustainable agriculture and disease management. Traditional diagnostic approaches such as visual inspection, culturing, and PCR, as well as serology-based diagnostics, are sometimes constrained by their reliance on previous knowledge and inability to detect novel or unculturable pathogens. Metagenomics, on the other hand, provides a culture-independent, high-throughput technique for directly analyzing whole microbial populations in plant or environmental materials. This comprehensive technique allows for the simultaneous detection of several pathogens, including fungus, bacteria, viruses, and oomycetes, which improves disease diagnosis and knowledge of plant health dynamics. Sterile sample of both symptomatic and asymptomatic tissues, nucleic acid extraction, library preparation, and sequencing using platforms like PacBio, Oxford Nanopore (MinION), and Illumina are all included in the metagenomic diagnostic approach. Taxonomic classification, functional annotation, host genome removal, and quality screening are all steps in the data processing process. Metagenomics offers information on microbial interactions, resistance genes, and community changes in damaged plants in

addition to diagnosis. Metagenomics has the potential to transform precision agriculture and integrated disease management in the face of climate change thanks to cutting sequencing costs and sophisticated bioinformatics pipelines.

Keywords: *Bioinformation; Diagnostics; Metagenomics; Pathogen interaction; Plant disease; Precision agriculture*

A thematic review for bridging gender gaps via gender sensitization towards climate change in Indian agriculture

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ABSTRACT

Gender which is defined as a social construct showcases the social dynamics & relational aspects between men and women which leads to several differential position and importance in the society. Gender sensitization serves as a transformative tool to reshape entrenched societal norms that define and perpetuate gender inequalities, particularly within the agrarian and climate-vulnerable landscape of India. In India, where atmospheric aberrations are occurring rapidly, climate change poses a risk of exacerbating existing health inequalities based on gender. Incorporating a gender-focused approach into current climate, development, and disaster-risk reduction policies can help mitigate adverse health impacts. Addressing climate risks necessitates coordination across various sectors, enhancements in data collection, tracking of gender-specific objectives, and fair involvement of all stakeholders. Despite women comprising a significant proportion of the agricultural workforce, their participation is often undermined by systemic gender biases, limited access to resources, decision-making exclusion, and information asymmetry. This review paper explores how gender sensitization intersects with climate change challenges, highlighting the disproportionate impacts on women and the urgent need to integrate gender perspectives into policy-making, adaptation strategies, and community engagement. Through a critical analysis of secondary literature and case studies, the study reveals that climate-smart, gender-inclusive interventions—such as access to technology, land ownership rights, and capacity-building—can empower women, enhance farm sustainability, and foster climate resilience. It underscores the importance of gender-responsive policies that prioritize inclusivity, equity, and active female participation across all levels—from grassroots to governance. Ultimately, gender sensitization emerges not just as a corrective measure, but as a catalyst for sustainable development and climate justice.

Keywords: *Climate change; Gender; Gender gaps; Gender sensitization; Indian agriculture*

Gut bacteria-mediated insecticide degradation in field-collected *Spodoptera frugiperda* populations from South India

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ABSTRACT

Fall armyworm, *Spodoptera frugiperda* is an invasive pest of maize with a global distribution, known for causing significant agricultural losses and exhibiting resistance to multiple insecticides. Notably, bacterial symbionts are increasingly recognized as contributing factors to the rapid development of insecticide resistance in major lepidopteran pests. In this study, four geographically distinct populations of *S. frugiperda* from South India were analyzed for their gut bacterial composition and insecticide-

degrading potential. Bacterial isolates from larval guts were screened for their ability to degrade insecticides such as lambda-cyhalothrin, chlorantraniliprole, emamectin benzoate, carbofuran, and spinetoram. High-throughput sequencing of the 16S rDNA gene revealed a predominance of *Enterococcus* species. The degradation capacity of selected bacterial isolates was further evaluated using GC or LC-MS/MS techniques. Growth in minimal salt media indicated that spinetoram underwent the least total degradation (6.38%), while chlorantraniliprole was most effectively broken down by bacterial activity (31.91%). These findings highlight the significant role of gut bacteria in mediating insecticide degradation in field populations of *S. frugiperda*, underscoring the importance of further research into bacterial contributions to insecticide detoxification and their implications for pest management strategies.

Keywords: *Fall armyworm; chlorantraniliprole; spinetoram; degradation; bacteria*

Powering the Future with Forage: Integrating Green Feed Innovation for Animal Welfare and Sustainable Farming

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ABSTRACT

Forage crops have not received enough attention in the context of the growing worldwide focus on sustainable farming, animal welfare, and food security-both in terms of research goals and policy. By presenting forage as a strategic resource that links agriculture, the environment, energy, and animal health, rather than just as animal feed, this talk seeks to change that perception. The function of forage crops, such as oats, sorghum, forage maize, and napier grass, which are nutrient-rich, fast-growing, and environmentally friendly, needs to be rethought. In addition to their main function in cattle nutrition, these crops are interesting choices for the generation of bioenergy since they promote rapid biomass buildup, root intensification, and carbon capture.

One of the primary takeaways from this is the moral and ethical gap (Illustrated in Fig-1) in our agricultural systems: despite our continuous innovations in human food and nutrition, livestock's nutritional needs-particularly those related to quality, palatability, and variety-remain disregarded. However, animals are essential to our rural economies, livelihoods, and food systems. By promoting "happy hormones" like dopamine, endorphins, and serotonin, palatable, soft, and varied green forages can have a positive impact on animals' mood, metabolism, and productivity. This is an exciting new frontier in animal behavior and nutritional science. greater feed essentially results in happier, healthier animals with improved welfare, not just greater milk or meat. To achieve this, a cross-disciplinary approach can be adapted (Mentioned below):

Collaborative Framework for Forage Innovation and Livestock Welfare

Finding climate-resilient forage crops that can adapt to a variety of agroclimatic situations and provide a high biomass output, such as Pennisetum, Forage sorghum, and oats, is the main goal of this phase. Advanced breeding techniques are used to improve characteristics like quick regrowth, digestibility, palatability, and protein content.

In order to create a solid germplasm base and specific varietal recommendations, the goal is to produce varieties that are appropriate for both fresh and preserved forms.

Following this, biochemists, microbiologists, and food nutritionists will take charge of detailed nutritional profiling. They evaluate the forage for essential nutrients like protein, fiber, minerals, and sugars while assessing its fermentation characteristics and storage behavior with the help of Biochemists. There is also a focus on improving nutritional value by incorporating natural additives such as probiotics, essential oils, and flavor agents. This step results in clear nutritional labels, digestibility ratings, and microbial compatibility profiles.

Animal behavior specialists, livestock nutritionists, and veterinary professionals oversee the next step, which consists of feeding trials for animals. These experiments evaluate the animals' performance, health, and taste responses to the novel feeds. Feed intake behavior, milk production, weight gain, and indicators of wellbeing associated with the release of mood-enhancing chemicals such as dopamine, oxytocin, and serotonin are among the observations. The results support the idea that improved forage improves animal productivity and health.

Forage agronomists and biochemists then work on product development, concentrating on developing formats that are easy to store. To increase shelf life and preserve nutritional integrity, innovations including moisture-stable haylage, flavored feed blocks, and vacuum-sealed silage can be created. These ready-to-use items are made to be portable and useful on agricultural land.

Packaging and branding are the next areas of focus for consumer researchers and agri-marketing specialists. They design eye-catching, educational labels that include comprehensive nutritional and usage details. Positioning the forages as high-quality products, whether for organic markets or regional consumption, is the aim. Demand and visibility are increased through market trials conducted by local dealers, dairy cooperatives, and online platforms. Lastly, the model's scaling through farmer cooperatives and fodder clusters will be looked by extension scientists. Developing inventory systems and providing logistical support ensures effective storage, distribution, and seasonal availability. Concurrently, initiatives are undertaken to promote policies that are beneficial, like insurance coverage, certification requirements, and subsidies for fodder. This guarantees a farmer-inclusive, sustainable approach that is prepared for widespread adoption.

Conclusion:

With following the above collaborative approach viz., An integrated forage system where: Breeders will be able to grow better crops & varieties, Biochemists validate nutrition, Farmers feed smarter, Animals perform and yield better and markets respond to quality forage products like never before.

Keywords: *Forage; Animal Nutrition; Animal Welfare*

Millets: The Climate-Smart Crop for A Sustainable Future

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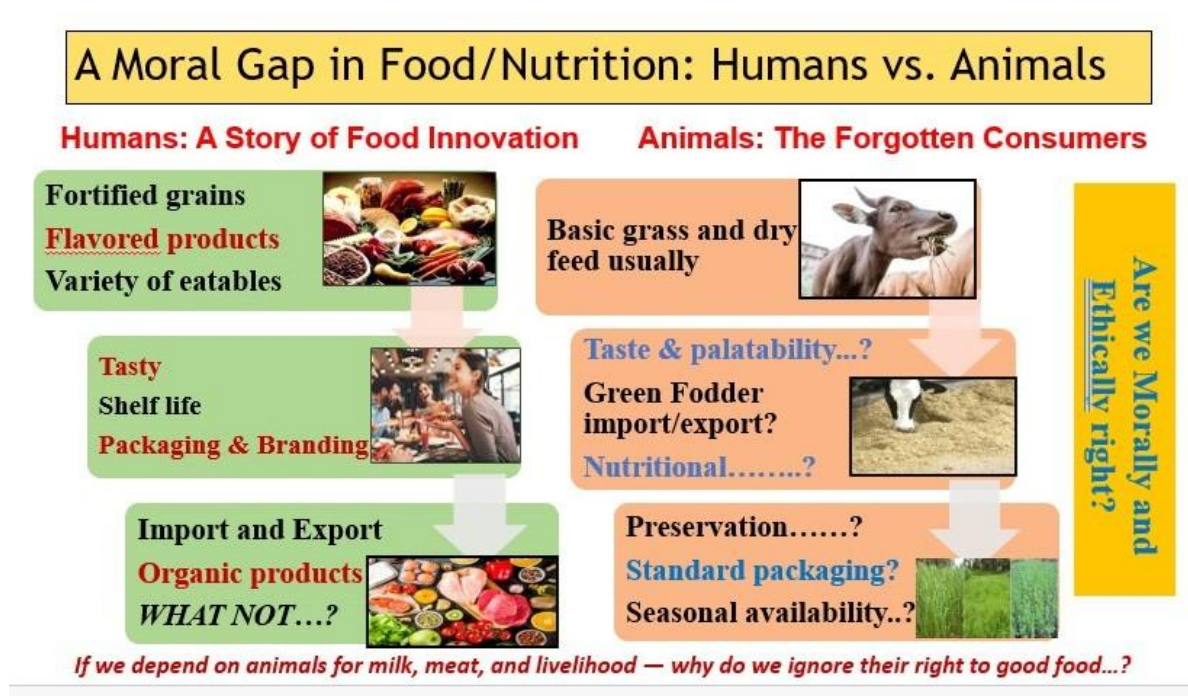
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ABSTRACT

Climate change is one of the greatest challenges our planet is facing today. It is affecting every aspect of our lives, including our food systems causing malnutrition among people. The climate change impacts agriculture sector disproportionately. This paper explores the role of millets in creating a sustainable food system that can address the challenges of climate change and triple burden of malnutrition. Millets are highly nutritious and contain high amounts of protein, fibre, vitamins, and minerals. The crop's deep root system can improve soil structure, water infiltration, and soil fertility, leading to increased soil carbon sequestration. Millet also has the potential to contribute to carbon sequestration in agroforestry systems by providing shade and ground cover for trees. The paper also delineates the initiatives taken to promote millet production and consumption. The paper explains in detail how the easy with short growing season and high yielding cultivation of millets. This making it a suitable crop for small land holder farmers who have limited resources and access to irrigation. Overall, millets are a sustainable crop that promotes the conservation of the environment. They have several environmental, nutritional, and economic benefits, making them an ideal crop for smallholder farmers in low rainfall regions. Therefore, promotion of cultivation of smart crops like millets will resolve the issue of climate change and food scarcity and will pave the way for sustainable future.

Keywords: *smart-crop; millets; sustainable future; climate change; malnutrition; economical*

Fig-1: Illustration of Moral Gap in Food: Humans and Animals



Development of Callus Cells of Darjeeling Mandarin for Evaluation under Successive Aluminium Stress under In-vitro Condition

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ABSTRACT

Darjeeling Mandarin (*Citrus reticulata* Blanco.), a well-esteemed citrus variety, faces considerable challenges due to high aluminium (Al^{3+}) toxicity in the hills of Darjeeling. Despite this well-known fact, there is very few attentions had been made so far to evaluate the impact of aluminium ions in the cellular level of mandarin. Hence, the present investigation was conducted to standardize the in-vitro callogenesis protocol of Darjeeling Mandarin for accelerated cellular evaluation under controlled stress conditions. The experimental observations revealed that cotyledonary leaf are more capable of producing callus cell than the internodal segment of mandarin. Surface sterilization treatments also revealed that $HgCl_2$ @ 0.1% for 10 minutes gives lowest contamination percentage (6.67 % for cotyledons; 44.44% for internodal segment) in both the explants, but $NaOCl$ @ 2% for 10 minutes give the highest recovery percentage (53.33% for cotyledons and 41.11% for internodal Segment) for both the explants. In order to ensure successful callus induction, the research focuses on optimising growth regulator combinations (2,4-D, NAA, and BAP) in MS media for further refining of callogenesis protocol. After the callus formation, the callus was transferred to the media containing Aluminium ions. The Aluminium toxicity exposure was given in successive manner ranging from 10 ppm to 80 ppm using Aluminium chloride salt. The experiment is still continuing with a vision of accessing the impact of aluminium ions on the cellular level.

Keywords: Darjeeling Mandarin; Aluminium Toxicity; Tissue Culture; Metal Stress

Kisan Rail – A Boon For Farmers.**Pise Onkar Namdeo***Institute of Agricultural Sciences, BHU, Varanasi, India.***ABSTRACT**

In line with the Union Budget 2020-21 announcement, the Indian Railways is establishing Kisan Rail routes equipped with refrigerated coaches in Express and Freight trains. These rails aim to provide small and marginal farmers a means to transport perishable goods to larger markets.

Circuits for Kisan Rail services are identified in consultation with various agriculture and state departments to ensure efficient and demand-driven operations. The first kisan rail was launched on August 2020 between Devlali (Maharashtra) to Danapur (Bihar). Overall, the Operation Greens Scheme and the Kisan Rail initiative are vital steps towards promoting a more efficient and inclusive agricultural supply chain in India.

The scheme aims to protect growers from distress sales during lockdowns and reduce postharvest losses. Eligible crops under the scheme include a variety of fruits like mango, banana, and pomegranate, as well as vegetables such as onion, potato, and tomato. The scheme offers a 50% subsidy on transportation through Kisan Rail Services.

Eligible entities for the scheme include food processors, farmers, cooperatives, exporters, and retailers involved in fruit and vegetable processing and marketing. Claim submission for subsidies is done via an online portal without prior approval required from the Government of India.

Keywords: *Perishables; Refrigerated coaches; Farmers; Transportation; Freight; Subsidy; Kisan Rail*

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A Study On Relationship Of Socio-Economic Varieties With Knowledge And Adoption Of Rural Women In Bihar**Sweta Kumari¹, Sudhanand Prasad Lal¹, L.B Singh¹ and Shailendra Kumar Yadav²**

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ABSTRACT

This study was conducted in the Samastipur district of Bihar, focusing on women's participation in home and farm activities within the social, cultural, and economic contexts of the area. Participation varies from reason to reason and family to family, depending on caste, class, and socio-economic status. A sample of 120 women trainees from ten villages across Pusa and Kalyanpur blocks was selected using purposive sampling. A pre-tested interview schedule was employed to gather data on key variables such as age, caste, education, marital status, family structure, income, landholding, housing, occupation, organizational membership, media exposure, and cosmopolitanism. The study measured women's knowledge levels using multiple-choice and yes/no questions, and adoption was evaluated through engagement in activities like beekeeping, mushroom cultivation, fruit processing, and vegetable production. Statistical analysis revealed significant positive correlations between adoption and variables such as age, caste, education, marital status, family type, income, type of house, organizational membership, mass media exposure, and cosmopolitanism. Notably, family size showed a negative

correlation with adoption. In terms of knowledge, age and cosmopolitaness showed a significant positive relationship, while family size exhibited a negative effect. Other socio-economic factors like caste, education, marital status, occupation, income, landholding, housing type, and media exposure were not significantly correlated with knowledge. The findings highlight that although many women are actively involved in agro-enterprise activities, their level of knowledge and adoption varies depending on socio-economic conditions. This emphasizes the need for targeted extension services, awareness programs, and policy support to enhance rural women's knowledge and participation in agro-based enterprises. By strengthening their role in agriculture through access to training and technology, rural women can improve their economic independence and contribute meaningfully to rural development.

Keywords: *Agro-based enterprises; correlation; knowledge level; rural women; women's participation*

Navigating the Nexus: Economic Growth, Globalization, and Challenges for Sustainable Tourism **Rakesh Yadav**

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ABSTRACT

Economic growth and globalization are often seen as engines of progress, yet their complex interplay presents significant challenges for the sustainable development of the tourism sector. This paper investigates the complex relationship between these forces and their far-reaching implications for achieving environmental, social, and economic sustainability in the tourism sector. We look at how rising economic affluence drives travel demand, while globalization allows for unprecedented interconnection, cash flows, and cultural interchange, generating prospects for tourism expansion while exacerbating existing vulnerabilities.

The paper identifies key challenges stemming from this nexus, including environmental degradation due to over tourism and increased carbon footprints, socio-cultural erosion through commodification and loss of local identity, and economic leakages that limit benefits for host communities. Furthermore, we analyze the uneven distribution of globalization's benefits, highlighting the intensified competition, market volatility, and ethical dilemmas faced by destinations striving for long-term viability. By examining diverse case studies and theoretical frameworks, this research proposes a comprehensive understanding of these multifaceted challenges and suggests innovative policy recommendations and strategic approaches for stakeholders to navigate this complex landscape, fostering a more resilient, equitable, and sustainable future for global tourism.

Keywords: *Economic growth; Globalization; Sustainable tourism; Carbon footprint; Environmental degradation; Socio cultural erosion*

Fostering student entrepreneurship is a pathway to gender-inclusive, climate-smart, and policy-relevant agricultural innovation

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Purpose of the study

Entrepreneurship among students is perceived to be one of the crucial tactics to build a strong and flexible farming system to address climate vulnerability and increasing unpredictability in farming. With an aim to analyse the role of students in sustainability and climate resilient Agri enterprises, this

study emphasizes on the entrepreneurial ambitions of undergraduate students of University of Agricultural Sciences, Raichur with a special focus on gender implications and their potential for the contribution to sustainable Agri enterprises and climate smart agriculture.

Material and Methods

The research was conducted with a sample size of 426 students from first and final year B.Sc. (Hons.) Agriculture of three agricultural colleges of UAS, Raichur. Sample were selected through random sampling method. A structured questionnaire was used to collect responses from the respondents to investigate student's perception and aspiration levels under four domains of interest: Educational, career, entrepreneurial and self-reliance aspirations. The data collected was analyzed statistically using Mann-Whitney U test to examine the gender-based differences in aspiration levels.

Results

The findings depicted that, majority of the students were well aware of the various challenges associated with entrepreneurship wherein majority of students identified financial risks, market competition and market uncertainties as major concerns. Regarding aspiration levels both boys (50.00 %) and girls (58.53 %) students exhibited a moderate level of overall aspiration, with a slightly greater proportion of girls coming under this category as compared to boys. In terms of career aspiration, less than half of boys (48.09 %) and girls (44.51 %) had medium level of aspiration. Even in terms of entrepreneurial aspiration, less than half (46.94 %) of boys and 38.41 per cent of girls had medium level of aspiration. But in case of self-resilience aspiration, 40.07 per cent of boys and 37.19 per cent of girls had high level of aspiration. Further, the obtained scores were compared using Mann-Witney U test to know the significant difference between aspiration level of boys and girls. Even though both boys and girls show moderate level of entrepreneurial and career aspiration, girls show relatively higher overall aspiration level, particularly in self-reliance. This shows that there is statistically significant gender difference among boys and girls pertaining to aspiration level.

Conclusion

Despite the fact that both male and female students confirm that they have moderate levels of entrepreneurial and career aspirations, whereas female students show comparatively stronger inclination towards self-reliance and overall aspirations. These findings underline the importance of gender-sensitive entrepreneurship development programs in agricultural universities to harness the full potential of youth for sustainable agricultural transformation.

Keywords: *Sustainable agri-enterprises; aspiration; self-resilience; gender difference; career aspiration*

Climate Literacy and Education In Schools/Colleges

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ABSTRACT

Climate change is one of the most pressing challenges of our time, threatening ecosystems, economies, and human well-being globally. Addressing this crisis demands more than technological interventions and policy shifts—it requires a transformation in the way individuals, particularly the younger generation, understand, engage with, and act upon environmental issues. Climate literacy emerges as a vital educational priority, equipping students with the knowledge, skills, attitudes, and values necessary for sustainable living and informed decision-making. This session explores the significance of embedding climate education in school and college curricula as a strategy to build awareness, resilience, and proactive engagement among youth. It highlights key components of effective climate education, including curriculum integration across disciplines (science, geography, economics, humanities),

experiential learning opportunities (eco-clubs, citizen science, green campus programs), and the integration of digital tools and ICT-based platforms for immersive learning.

A critical focus is placed on teacher training and capacity building, ensuring that educators are empowered to deliver climate content confidently and meaningfully. The paper also analyzes relevant policy frameworks, such as India's National Education Policy (NEP) 2020 and UNESCO's Education for Sustainable Development (ESD), to assess how institutional support can enhance climate literacy efforts. Drawing from a pilot survey conducted among high school and college students across urban and rural areas, the study reveals significant gaps in climate knowledge and engagement. These findings underscore the urgent need for inclusive, action-oriented, and interdisciplinary approaches to climate education that connect classroom learning with real-world environmental challenges.

By showcasing successful models and innovative pedagogies, this session aims to inspire educators, institutions, and policymakers to prioritize climate literacy as a foundational element of education systems. Ultimately, fostering climate-conscious youth is not just an academic endeavor but a strategic investment in a sustainable and resilient future aligned with global climate goals and the Sustainable Development Agenda.

Keywords: *Climate literacy; education for sustainable development; climate change; school curriculum; youth engagement; teacher training; NEP 2020; climate resilience*

Survey Of Some Native and Exotic Angiospermic Plant Species In District Rampur Uttar Pradesh, India

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ABSTRACT

The observational study conducted in Rampur district, covering an area of 2,367 km², aimed to explore its floristic diversity. A total of 526 plant species were documented, representing 398 genera and 109 families. Among these, dicotyledons comprised 419 species from 308 genera and 87 families, while monocotyledons accounted for 107 species from 90 genera and 22 families. Notably, Poaceae, Fabaceae, and Asteraceae emerged as the most dominant families within Rampur district's flora. Analysis of the origin status of the flora revealed that 217 plant species (41.25%) were native to the region, while 309 species (58.75%) were identified as exotic. This distribution highlights the significant presence of non-native species within the district's plant community. These findings provide valuable insights into Rampur district's floral wealth, shedding light on the diverse array of plant life present in the region. However, the prevalence of exotic species underscores the importance of monitoring and managing non-native flora to maintain ecological balance and preserve native biodiversity.

Keywords: *Exotic flora; Native flora; Northan Uttar Pradesh; Indo-Gangetic Plains; district Rampur*

Evaluation of timing of nitrogen application in maize (*Zea mays* L.) Grown on coarse loamy typic haplustept soil of punjab

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ABSTRACT

An investigation was conducted to evaluate the timing of nitrogen application, combined application of neem-coated urea and nano-urea with organic manures in maize (*Zea mays* L.) cultivated in Punjab's coarse-loamy Typic Haplustept soil. The study was carried out at Lovely Professional University's Soil Science research farm in Punjab during the kharif seasons of 2022 and 2023. The field investigation was conducted in randomized block design and consisted of sixteen treatments in experiment one and two treatments in experiment two. Both the experiments were conducted with three replications. Treatments comprised of the use of farm yard manure, vermi-compost, nano-urea and neem coated urea in different doses and timing of application. Plant height data indicated four clear cut stages of maize growth at 42, 56, 65 and 89 days of sowing. Plant growth stage at 42 days near to the knee-high stage and 65 days stage near to the tasseling stage of the maize match with the already recommended dose of nitrogen fertilizer. Plant height growth stages of maize at 56 and 89 days needs consideration by further splitting of nitrogen fertilizer application for improving maize productivity and increasing fertilizer urea efficiency. Application of nano-urea did not show any significant advantages as compared to recommended dose of fertilizer nitrogen application. Integrated use of vermi-compost @2.5t ha⁻¹ along with the RDF application has an added advantage over all other treatments. However, further field trials in different agro-ecological zones are necessary for any final recommendation to the farmers.

Keywords: Nano-urea; vermi-compost; maize; coarse loamy soil

Remote Sensing-Enabled Web Application for Crop Growth Stage and Water Demand

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ABSTRACT

The present study was undertaken to develop and evaluate a remote sensing-enabled web application for near-real-time monitoring of crop growth stages and water requirements. Multitemporal Sentinel-2 Surface Reflectance Harmonized data (2022–2024) were utilized to compute the Normalized Difference Vegetation Index (NDVI) using the near-infrared (B8) and red (B4) bands. Crop coefficient (Kc) values were estimated using the empirical relationship $Kc = 1.25 \times NDVI - 0.2$ (Campos et al., 2017). The growth stages of the crop were identified from temporal variations in Kc, which enabled the estimation of stage-wise crop evapotranspiration (ETc) using the FAO-56 equation $ETc = Kc \times ETo$, where ETo was obtained from local climatic datasets. For example, an NDVI of 0.643 resulted in a Kc value of 0.604, giving an ETc of 3.02 mm/day for an average ETo of 5 mm/day. The developed interactive web application integrates NDVI mapping, Kc computation, and ETc estimation to provide actionable decision support for precision irrigation scheduling. The tool demonstrated strong potential for optimizing water use efficiency and supporting sustainable agricultural water management practices across diverse cropping systems.

Keywords: *Crop coefficient; NDVI; evapotranspiration; Sentinel-2; irrigation scheduling; precision agriculture*

Soil biodiversity and human health

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ABSTRACT

Biodiversity is important for the maintenance of soil quality. Healthy, bio diverse soils are crucial for human health and wellbeing from several reasons, for example: biodiversity has been shown to be important in controlling populations of pathogens; healthy, well-covered soils can reduce disease outbreaks; carbon-rich soils may also reduce outbreaks of human and animal parasites; exposure to soil microbes can reduce allergies; soils have provided many of our current antibiotics; soil organisms can provide biological disease and pest control agents, healthy soils mean healthier and more abundant foods; soil microbes can enhance crop plant resilience; healthy soils promote good clean air quality, less prone to wind and water erosion; and healthy soils provide clean and safe water through filtration, decontamination by microbes and removal of pollutants. Soil microbes and other biota provide many benefits to human health. Soil microbes are a source of medicines, such as antibiotics, anticancer drugs and many more. Organisms that affect soil health and thus human health include those involved in nutrient cycling, decomposition of organic matter and determining soil structure (e.g. aggregation). Again these are related to food security but also affect human health in other ways. Many beneficial organisms have been isolated from soil - plant growth promoting and disease suppressive microbes used as inoculants, foliar inoculants for improvement of ruminant digestion systems and inoculants used in bioremediation of toxic compounds in the environment. Soil biodiversity is highly recognized now as an important feature of healthy soil and imbalances have been shown to give advantage to harmful over beneficial organisms. This presentation will highlight the many connections of biodiversity to soil quality and human health.

Economic Impact Assessment of Pigeon pea, Green gram & Black gram variety released by Dr.PDKV, Akola

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ABSTRACT

India is the largest producer, consumer and importer of pulses in the world. Since more than 80 per cent of the area under pulses is in a stressed rainfed environment, the quality seed of improved varieties has emerged as the most vital input for enhancing pulse production in India. In this context, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola has made significant progress by releasing 11 excellent varieties of Pigeon pea, Green gram & Black gram. PKV Tara, Kopergaon and TAU 1 are the popular varieties in the region for Pigeon pea, Green gram & Black gram, respectively. The main objective of this study, to assess the economic impact of University-released pulses varieties. Partial budget approach was used for estimating the impact of research outcome on income generation. The result revealed that, the total economic worthiness of University released Pigeon pea, Green gram and Black gram production technology over other local competing varieties of Pigeon pea, Green gram and Black gram in the region

were Rs. 9654.09/-, Rs. 7511.01/- & Rs.14608.12/- per hectare respectively. It indicates that, the Net Economic Impact to the farming community in Maharashtra state were Rs.12.65, Rs.0.16 and Rs. 58.92 crores for Pigeon pea, Green gram and Black gram respectively in the year 2019-20. The area under University released Pigeon pea, Green gram and Black gram varieties for the year 2019-20 were 33080.40, 304.02 and 58560.75 hectare respectively.

The Gross economic impact of University released varieties of Pigeon pea, was Rs. 841.68 Crores for six year. Green gram and Black gram were Rs. 1383.20 crores and Rs. 3904.72 crores for 15 years respectively. It is concluded that, as per the demand of farmer, it is need to increase the seed production of PKV Tara, Kopergaon and TAU1 varieties of Pigeon pea, Green gram and Black gram. Hence it is necessary to submit the proposal for re-notification of the variety. It is therefore recommended that government should provide substantial funds to the University for further Research and Extension of their varieties for benefit of the farming community.

Evaluating Biosurfactant as Biocontrol Agents: From Soil to Solution

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ABSTRACT

The increasing global population has heightened food demand, leading to escalated pesticide use in agriculture. However, chemical pesticides, while effective in pest control, pose a significant threat to the environment due to their reported activity. Persistence of these chemicals in soil and water bodies impacts the ecosystem and the food chain due to their toxic and non-biodegradable nature. This study aims to evaluate microbial-origin biosurfactants as an alternative to chemical pesticides, considering their biodegradability and robust stability in diverse environmental conditions, including high temperatures, pH, and salinity conditions. This study also evaluates the effect of crude biosurfactant on plant growth, which is under the influence of a fungal pathogen.

Bacterial isolates from plant endophyte were screened for biosurfactant-producing capability, and one promising strain was identified. The selected isolate was identified as *Enterobacter* using 16S RNA sequencing. The selected isolates were optimized for enhanced production and stability of the biosurfactants. The obtained biosurfactants were characterized using FTIR and GC-MS for their classification. The lipopeptide-type biosurfactant obtained was evaluated for biocontrol activity against selected fungi (*Pythium aphanidermatum* and *Phytophthora capsici*). Significant bioactivity was observed against *Phytophthora capsici*, and its MIC was determined. Microscopic analysis using scanning electron microscopy was conducted for structural changes leading to inhibition. Furthermore, this extract was used on a tomato plant that was infected with *Phytophthora capsici*, and the extracted crude biosurfactant was applied to it to analyse its effect. Results concluded the extract helped the plant in priming its defence system and helped the plant in fighting the infection, thus improving its health as compared to an infected plant which was not given any treatment, thus suggesting their use as potential fungicide or bio-pesticide against specific pathogens.

Keywords: *Biosurfactant; Plant pathogen inhibition; Phytophthora capsici; Lipopeptide*

Spatio-temporal LULC Changes and Morphometric-Based Watershed Prioritization of West Tripura District, India using Remote sensing and Open- Source GIS tool**Swapnajit Chowdhury¹, Alivia Chowdhury¹, Manoj Kumar Nanda²**¹*Department of Soil and Water Engineering, Bidhan Chandra Krishi Viswavidyalaya, Nadia, West Bengal, India.*²*Department of Agricultural Meteorology and Physics, Bidhan Chandra Krishi Viswavidyalaya, Nadia, West Bengal, India.***ABSTRACT**

Land resources worldwide are under increasing pressure due to a range of anthropogenic activities, notably population growth, agricultural intensification, urbanization, and extensive mineral extraction. Water, vegetation, and other resources that are essential for the survival of all species on Earth are becoming limited for a variety of reasons, including reduced infiltration rates, runoff, uneconomical usage, excessive use of surface water, and vegetation caused by land-use change in a watershed which can affect water quality and supply. This study investigates the dynamics of Land Use and Land Cover (LULC) changes over the past two decades and evaluates watershed characteristics through morphometric analysis in the West Tripura district of India. Multi-temporal Landsat satellite imagery was analyzed using the Random Forest classification algorithm to detect LULC changes. The results indicate a notable increase in settlement areas, barren land, tree vegetation, and water bodies, while cropland, scrubland, and submerged areas have declined during the study period.

Furthermore, morphometric analysis was conducted for ten (10) sub-basins within the study area using Digital Elevation Model (DEM) data derived from the Shuttle Radar Topography Mission (SRTM). Key linear and aerial parameters—including basin area, perimeter, stream length, and basin length—were computed to derive indices such as drainage density, drainage texture, bifurcation ratio, stream frequency, stream length ratio, mean stream length, and circularity ratio. Based on these parameters, watershed prioritization was performed to assess susceptibility to hydrological risks. The analysis classified six (6) sub-basins as high priority, three (3) as medium priority, and one as low priority, indicating varying degrees of vulnerability to surface runoff, peak flow, and soil erosion. These findings provide critical insights for sustainable watershed management and land use planning in the region.

Keywords: *Landsat imageries; DEM; SRTM; Random Forest***The impact of forest bioeconomy on livelihood security and income inequality mitigation in the Gurez Himalaya, India****M.A. Islam, Ummar Atta, A.A. Wani, A.A. Gatoo, Murtaza Shah, K.A. Sofi, G.M. Bhat and A.A. Parrey***Division of Natural Resource Management (NRM), Faculty of Forestry, SKUAST-K, Benhama, Ganderbal, (J&K), India.***ABSTRACT**

In Indian Himalayan tribal communities, the forest bioeconomy plays a significant role in livelihood security and income inequality mitigation. This study investigated the extraction of forest resources for livelihood security, economic value, livelihood contribution, income inequality mitigation, and determinant factors influencing household forest income among Shina tribe in Gurez Himalaya. For the survey, a multi-stage random selection technique was used for selecting the blocks (3), villages (18), and homes (337). Structured interviews, focus group discussions, non-participant observations, and rapid market assessment were used to gather primary data. Data were analyzed using multiple regressions and descriptive statistics. Results indicated that the total economic value of the forest resources extracted was ₹ 10357156/year, including both subsistence (₹ 3973887.58/year) and cash income (₹ 6383268.65/year), with an average of ₹ 30733.4/household/year. The average income was ₹ 92811.24/household/year, with forest resources (20.41%) accounting for the third largest contributor to

the tribal economy. The Gini coefficients with forest income (0.2873) and without forest income (0.3539) indicated that forest income had a stronger (6%) equalizing effect on income distribution. Regression analysis exhibited that herd size, main occupation, annual income, proximity to forests, forest visits, and household forestry had statistically significant effects on forest income. $R^2=0.920$ indicated that all of the variables combined accounted for 92.00% of variation in forest income. The results could serve as vital bases for creation of specific plans, policies, and strategies for sustainable forest management, livelihoods reliance and reduction of inequality.

Keywords: *Forest bioeconomy; livelihoods; inequality mitigation; Shina tribe; Gurez; Kashmir*

Soil and Human Health

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ABSTRACT

Soil influences human health in a variety of ways, with human health being linked to the health of the soil. Historically, emphasis has been placed on the negative impacts that soils have on human health, including exposures to toxins and pathogenic organisms or the problems created by growing crops in nutrient-deficient soils. However, there are a number of positive ways that soils enhance human health, from food production and nutrient supply to the supply of medications and enhancement of the immune system. It is increasingly recognized that the soil is an ecosystem with a myriad of interconnected parts, each influencing the other, and when all necessary parts are present and functioning (i.e., the soil is healthy), human health also benefits. Despite the advances that have been made, there are still many areas that need additional investigation. We do not have a good understanding of how chemical mixtures in the environment influence human health, and chemical mixtures in soil are the rule, not the exception. We also have sparse information on how most chemicals react within the chemically and biologically active soil ecosystem, and what those reactions mean for human health. There is a need to better integrate soil ecology and agronomic crop production with human health, food/nutrition science, and genetics to enhance bacterial and fungal sequencing capabilities, met genomics, and the subsequent analysis and interpretation.

Genetic Dissection of Yield and Quality Attributes in Wheat Using Six-Parameter Model Across Five Crosses

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ABSTRACT

The present investigation employs generation mean analysis to elucidate the nature of gene action governing yield and quality traits in bread wheat (*Triticum aestivum* L.). Five diverse crosses—HD 2967 × PBW 343, DBW 296 × DBW 327, UP 2338 × NP 200, MACS 6478 × DBW 327, and UP 2338 × UP 2847—were evaluated through six basic generations (P_1 , P_2 , F_1 , F_2 , BC_1 , BC_2). The study revealed that most traits exhibited significant mean effects, with dominance (h) effects generally outweighing additive (d) effects. Widespread epistatic interactions—particularly additive × additive and dominance × dominance—highlighted the complexity of trait inheritance. Grain yield, test weight, protein content, and days to heading exhibited strong non-additive gene effects, implying that delayed selection in segregating generations may enhance breeding efficiency. The results advocate for the integration of generation-wise strategies in wheat improvement programs, particularly under resource-constrained and yield-unstable environments.

Keywords: *Gene action; Generation mean analysis; Wheat breeding; Additive and dominance effects; Epistasis; Grain yield*

Social Dimensions of Climate Change

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ABSTRACT

Extreme weather events are deeply intertwined with global patterns of inequality. The poorest and most vulnerable people bear the brunt of climate change impacts yet contribute the least to the crisis. As the impacts of climate change mount, millions of vulnerable people face disproportionate challenges in terms of loss of jobs, extreme events, health effects, food, water, migration and forced displacement, loss of home, shelter and community ties, and other related risks. Some people are more vulnerable to climate change than others. For example, workers in sectors such as agriculture, fishing, and tourism rely on natural resources that are particularly sensitive to increasingly unpredictable weather and seasonal patterns. Female-headed households, children, persons with disabilities, Indigenous Peoples and ethnic minorities, landless tenants, migrant workers, displaced persons, older people, and other socially marginalized groups often have fewer financial and other resources to cope with and recover from shocks which might threaten their wellbeing and the wellbeing of their families. The root causes of their vulnerability lie in a combination of their geographical locations; their financial, socio-economic, cultural, and social status; and their access to resources, services, and decision-making power. The poor are often not just among the most vulnerable to climate change, but also disproportionately impacted by measures to address it. These impacts can include increased costs of living, loss of livelihoods, and limited access to resources and support systems, which exacerbate existing inequalities and poverty trends. In the absence of well-designed and citizen-centered policies, efforts to tackle climate change can have unintended consequences for the livelihoods of certain groups, including placing a higher financial burden on poor households.

Optimizing growth and yield in direct seeded finger millet [*Eleusine coracana* (L.) Gaertn] through integrated weed management

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ABSTRACT

A field experiment was conducted at Agricultural Research Station, Binjhagiri, Chatabar farm, FAS, SOADU, Bhubaneswar, Odisha, during kharif 2024. It consisted of 12 treatments. The experiment was laid out in randomized block design and replicated thrice. The predominant weed species infesting in the experimental crop included grasses like; *Eleusine indica*, *Dactyloctenium aegyptium*, *Digitaria sanguinalis*, *Cynodon dactylon*, *Echinochloa colona*, *Chloris barbata* and broad-leaved weeds like; *Euphorbia hirta*, *Amaranthus viridis*, *Ludwigia parviflora*, *Cleome viscosa* and *Mimosa pudica*. Pre emergence application of isoproturon @ 0.5 kg ha⁻¹ as PE (1-2 DAS) fb one hoeing and hand weeding at 35 DAS recorded the minimum values of weed density and dry weight and maximum weed control efficiency as well as the maximum values of growth parameters, yield attributes and yield, which was followed by the treatments hoeing and hand weeding at 20 & 35 DAS and Nerium oleander extract @ 2.5% as PE (1-2 DAS) fb one hoeing and hand weeding at 35 DAS. It is concluded that Pre emergence application of isoproturon @ 0.5 kg ha⁻¹ as PE (1-2 DAS) fb one hoeing and hand weeding at 35 DAS, can be recommended to the finger millet growers for satisfactory weed management for achieving maximum grain yield and productivity. Among botanicals Nerium oleander extract @ 2.5% as PE (1-2 DAS) fb one hoeing and hand weeding at 35 DAS which is statistically at par with Nerium oleander extract @ 2.5% as PE (1-2 DAS) + Nerium oleander extract @ 2.5% as PoE 35 DAS can also be recommended as an eco-friendly weed management practice without appreciable loss in productivity and profitability.

Keywords: Direct seeded finger millet; isoproturon; botanicals; weed management

Influence of Nitrogen sources as organic manure, inorganic manure and biofertilizers in growth and seed yield of maize at Chitwan, Nepal**P. Neupane¹ and D. Bhusal¹***Department of Agonomy, Agriculture and Forestry University, Chitwan***ABSTRACT**

A field experiment was conducted to study the effect of different combinations of nitrogen sources (inorganic, organic manure, and biofertilizer) and its combinations on growth and yield of spring maize at Rampur, Chitwan from February 2022 to June 2022. The experiment was laid out in randomized complete block design comprising of eleven treatments with three replication. The data on phenology, growth, and yield attributes and seed yield were recorded and analyzed through R-studio. There was a significant effect of integration of nitrogen sources in all the parameters analyzed. Results revealed an increment of yield by 120% to 167.30% with the use of integration over the control treatment, whereas 4% to 15% increment over sole use of urea. The highest seed yield (4.25 t ha^{-1}) was recorded in treatment 50% N as urea + 25% N as castor cake + Azotobacter, observed at par with 75% N through urea+ Azotobacter which was followed by 100% N as urea whereas lowest was observed in control. The highest yield was as a result of higher cob weight (172.53 g), cob length (17.45 cm), cob diameter (4.85cm), kernel number (417.80), kernel weight (124.13g), and thousand kernel weight (287.33g). Integration of nitrogen sources viz. 50% N as urea + 25% N as castor cake + Azotobacter found higher growth and seed yield of spring maize in Chitwan.

Keywords: *Plant growth; yield; Azotobacter; Castor cake***Assessing the Genetic diversity in Indian Cashew (*Anacardium occidentale* L.) Genotypes using Morphological and Molecular Markers****Vikas Ramteke¹, Jamboor Dinakara Adiga², E. Eradasappa², T. N. Raviprasad², Nemichand Mandawi¹, Padmakshi Thakur¹ and Devchand Salam¹**¹*Zonal Agricultural Research Station, Indira Gandhi Agricultural University, Jagdalpur, Chhattisgarh, India.*²*ICAR- Directorate of Cashew Research, Post Darbe, Puttur, Dakshina Kannada, Karnataka, India.***ABSTRACT**

Cashew (*Anacardium occidentale* L.), a key tropical nut crop, faces productivity challenges due to limited genetic improvement in India. Despite its economic importance, systematic evaluation of germplasm for yield and quality traits remains scarce, particularly in regions like Chhattisgarh. This study assessed 22 cashew genotypes from diverse Indian sources to unravel genetic diversity, identify superior traits, and guide breeding programs. We focused on morpho-agronomic traits, including tree architecture, flowering dynamics, nut yield, and biochemical quality, to pinpoint genotypes with potential for hybridization and cultivar development under tropical conditions. Cluster analysis grouped genotypes into four distinct clusters, with Cluster III (8 genotypes) showing the highest nut yield (4.71 kg/tree) and flowering intensity ($79.02/\text{m}^2$), while Cluster IV (3 genotypes) exhibited superior nut quality ($9.61 \text{ g nut weight}$, $2.97 \text{ g kernel weight}$). Cluster II (BPP 30/1) stood out as the most divergent, ideal for hybridization. Principal Component Analysis revealed 91.5% variability, with PC1 (41.7%) linked to yield-related traits (e.g., flowering laterals, nut yield) and PC2 (18.0%) to nut/apple weight. Significant correlations were observed: nut yield correlated positively with flowering laterals ($r=0.774$) and nuts/panicle ($r=0.572$), but negatively with prolonged flowering duration. Biplot analysis identified H-68, Vengurla-4, and H-303 as high-yielding genotypes, while H-255 and NRC-190 were optimal for nut size and juice quality. The study highlights the potential of inter-cluster crosses (e.g., Cluster II $\times$ III/IV) to combine high yield with premium nut traits. This study underscores the genetic

diversity among Indian cashew germplasm, providing a roadmap for targeted breeding. High-yielding genotypes (Cluster III) and large-nut varieties (Cluster IV) are prime candidates for hybridization, while divergent genotypes (Cluster II) offer novel trait combinations. Emphasis on flowering laterals (NFL) and nut weight can accelerate yield improvement. The findings advocate for integrating phenotypic and molecular tools to exploit heterosis, ensuring sustainable cashew cultivation in tropical agroecosystems. This work bridges the gap between germplasm characterization and practical breeding, addressing India's productivity challenges in cashew.

Keywords: *Cashew; Germplasm; Cluster; Nut Weight; Nut Yield; SSR Markers; PCA; D² Statistics; Breeding*

A review on relevance of Indian Knowledge System in Agricultural Extension

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ABSTRACT

The increasing challenges faced by modern agriculture call for the integration of time-tested, sustainable practices rooted in the Indian Knowledge System (IKS). India's ancient knowledge systems had uninterrupted tradition of knowledge transfer and unique point of view (Bharatiyu drishti) which is in need in the present. There is a need to draw the knowledge from the past and integration of IKS to solve the contemporary problems faced by the human-kind specially with respect to Agriculture. This review explores the historical foundations and contemporary relevance of IKS, particularly in the context of agricultural extension. Drawing upon a broad range of literature, including Vedic texts, manuscripts, folklore, oral traditions and recent empirical studies, the paper identifies indigenous sources of agricultural knowledge and evaluates their potential contribution for sustainable development. Findings indicate that IKS offers valuable insights into climate resilience, resource conservation and community-led innovation. Research studies such as traditional pest management in Uttarakhand and Nakshatra-based rainfall prediction in Karnataka highlight the scientific validity and local relevance of these practices. The review concludes that integrating IKS with modern science through participatory approaches like Participatory Technology Development and facilitative approach can enhance agricultural sustainability, empower smallholder farmers and strengthen climate adaptation. Extension systems thus play a critical role in bridging traditional wisdom and modern innovations for holistic agricultural development.

Keywords: *IKS; PTD; Agricultural Extension*

Environmental Justice and Equity Concerns: A Comprehensive Analysis

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ABSTRACT

Environmental justice has become a global imperative in the face of worsening climate crises and deepening socio-ecological inequalities. This study explores the unequal distribution of environmental harms and benefits, drawing on the IPCC AR6 Report (2023) and UNEP Emissions Gap Report (2024) to show how marginalized groups—especially in the Global South—disproportionately suffer from pollution, climate-induced displacement, and ecological degradation. Case studies from Delhi's air crisis, the Flint water disaster, and resource conflicts in the Congo Basin expose the environmental costs borne by disadvantaged populations. Using an intersectional lens, the study analyzes how gender, caste, ethnicity, and class shape environmental vulnerability, incorporating findings from UN Women (2023) and World Bank's "Poverty and Climate" Report (2024). It evaluates global frameworks like the Paris

Agreement, Escazú Agreement, and Kunming-Montreal Global Biodiversity Framework, identifying major gaps in implementation and equity outcomes. Despite climate finance commitments, actual disbursement remains low for frontline communities. This research critiques overreliance on market-based mechanisms such as carbon trading and offsetting, which often perpetuate injustice. Instead, it advocates for community-led adaptation, legal empowerment of affected groups, and just transition policies, aligning with COP28 (2023) outcomes and the broader climate justice movement. The paper concludes by offering equity-centered policy recommendations, including integration of environmental justice in national climate plans, participatory governance structures, and increased accountability in global climate finance mechanisms. By aligning with Sustainable Development Goals 10 (Reduced Inequality), 13 (Climate Action), and 16 (Justice and Institutions), the study positions environmental justice as a foundational requirement—not merely an aspirational ideal—for achieving a truly sustainable and inclusive global future.

Keywords: *Environmental Justice; Climate Equity; Intersectionality; Climate Governance; Just Transition; Paris Agreement; COP28; Sustainable Development Goals; Climate Finance; Marginalized Communities*

A Study of Impact and Evaluation of Traditional Practice (ITK) of Smoked Local Freshwater Fishes (*Bhuji Machhli*) by Fisherwomen & its Impact for Entrepreneurship Development in Rural Area

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EXTENDED SUMMARY

Introduction

Rural women role is important in freshwater aquaculture for development of fisheries because India vast and varied inland fisheries resources potentially one of the richest in the world. Women are equally endowed with motivation and managerial capabilities in starting and running. The participation of women in fisheries is well established and highlighted by several workers. On Survey it was found that the women have more practical knowledge towards indigenous technical knowledge (ITK) and active participation in fish culture practices alongwith their spouses. The Madhya Pradesh has been among the pioneering states in the country. It was found that in order to increase fish productivity of forms with the increasing awareness about women participation in different enterprises and their contribution to economy, intense efforts are being made at upgrading the skills of women and providing them with greater opportunities in fisheries sector in Madhya Pradesh.

The specific objectives of this study were to the level of adoption, impact of smoked fish in local fish market, to find the reasons for adopting traditional practices by fisherwomen in Chhindwara district and to explore their own rationale behind the use of this knowledge.

Objective

- (1) To understand the socio- economic profile of the fisherwomen.
- (2) To study the level of knowledge, adoption of indigenous traditional technical knowledge in post harvest of fish and attitude towards composite fish culture of fisherwomen.
- (3) To understand the reasons for the adapted smoked fish ITK by fisherwomen.

Material & Method

The study was conducted in Chhindwara district of Madhya Pradesh. Out of 9 development blocks of the district, 3 blocks were randomly selected. The list of fisherwomen was prepared, from the list, 30 fisherwomen were selected as respondents with the help of equal interval method of random sampling.

(A) Socio-economic profile of fisherwomen:- The study revealed that about 44 per cent of the fisherwomen were from middle age group categories followed by young and old age group, seventy six

per cent of the women came from backward class followed by Schedule Caste and Schedule Tribe. Majority of the fisherwomen belonged to nuclear family (84.00%) and had big size families (56.00%). (B) **Level of Knowledge of fisherwomen:-** Knowledge level of the fisherwomen in Table - 2 showed that a good majority (52.00 %) of the fisherwomen had medium knowledge level followed by low and high knowledge level about the composite fish culture practices. Almost all the respondents were having knowledge about the composite fish culture practices but to the varying degree. This may be attributed to their needs, interest and other environmental factors. (C) **Extent of adoption:-** The categorization of smoked fisherwomen according to extent of adoption of smoked fish production in Table - 3 shows that 72.00 percent of the smoked fisherwomen found to have adopted practices of smoking to high extent, Only 12.00 percent. (D) **Impact of smoked fish in local fish market:-** Regarding the impact of smoked fish it may be noted from Table - 4 that majority of the fisherwomen mostly accepted two modes for marketing of smoked fish.

Conclusion

The study concludes that the maximum fisherwomen were of middle age group, had medium level of education, backward class and belonged to nuclear family. Trapa -cum- fish was their main occupation. They had big family size and possessed had all types of net and boat as the main source of farm power and implements. Respondents had medium knowledge, medium adoption and favourable attitude toward composite fish culture of fisherwomen.

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Keywords: *Indigenous Technical Knowledge; Fisherwomen; Traditional Fish market Pattern*

Present Environment of Fisheries Sector towards Habits of Fish Food on Traditional Pattern

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ABSTRACT

The state of Madhya Pradesh is endowed with rich and varied inland fisheries resources, which include ponds, reservoirs and rivers. Rural women role is important in freshwater aquaculture for development of fisheries because India vast and varied inland fisheries resources potentially one of the richest in the world. The Madhya Pradesh has been among the pioneering states in the country. Chhindwara is one of Madhya Pradesh's districts, and is part of the state's Jabalpur division. In terms of total land area, it ranks as the first in all of Madhya Pradesh, having a land area of 11,815 square kilometer. This comprises about 3.85% of the state's total area. In Chhindwara 2.63 Lakhs (Women 1.28 Lakhs) tribals population, according to 1991 census. Fishermen of this area are mostly involved various technologies in fisheries over a period of time by trial and error, continuous observations, experiences and evaluation to use the traditional practices in this field. Women from rural area may an important role in establishing smoked fish and demand of dried prawn in market and also holding strong traditional marketing system for wet and dried prawn and do sell it round the year. The specific objectives of this study were to the availability, consumption and landing pattern of fishes, to find the available setting place and using their fish dressing equipments, carrier bags reasons for adopting traditional practices by fish traders, fishermen & fisherwomen in local fish market of Chhindwara district. The list of fish whole seller/traders, fish seller, fishermen & fisherwomen were prepared as respondents with the help of equal interval method of random sampling. The finding reveal that there is a good market, demand and price

for almost all the Indian major carps, varieties of indigenous local & catfishes. But, the supply is less as per demand and also poor due to environment of this local fish market. The major constraint of fish market under ownership of Municipal Corporation and also established at one place and no cement floor, storage facilities (Ice plant/ unit) nearly, high transportation charges, non-availability of skilled labor, and with non-availability of electric current regularly for freezing of fish were the important difficulties encountered by fish seller in market of Chhindwara town. The development of this local fish market are expected to significantly contribute in reducing post harvest losses, enhance revenue and also improve the hygienic environmental effect and sanitary conditions in fish markets.

Keywords: *Traditional Practices; landing pattern; Food habit; Domestic Fish market; Fishermen*

Assessment of hydrological and yield response of identified soil series under semi-arid watershed in Raichur District, Karnataka

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ABSTRACT

The water availability concerns have been increasing due to significant impacts of land use / land cover change, and climate variability. To evaluate the change in hydrological components and simulation of sediment yield and water yield on the small-scale with a change in runoff due to a change in land use / land cover in the watershed as well as the sub-watershed level to have an accurate estimation and simulation by finding the response of hydrological components toward its natural and human-induced factors. To quantify the significant changes affecting watershed to have a better understanding of the management plan regarding land use / land cover. High intensity rainfall causes floods; erosion and land degradation are experienced in some of part of the study area. The hydrological characteristics of the soil and water conservation structures in the study area inferred that a reduction of surface runoff, soil loss and improvement in potential recharge of the groundwater regime will take place with a favorable rainfall year. The analysis of rainfall pattern, runoff, silt estimation, nutrient loss, groundwater dynamics and the impacts of SWC measures have been summarized to improvise the efficient management.

Keywords: *Climate; Land use; Land Cover; Soil series*

Desalination of water - A remarkable approach to adapt environmental stress caused due to climate changes.

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ABSTRACT

Climate change is leading to increased droughts and water shortages in many regions, making desalination a vital alternative water source. To overcome the problem of water scarcity, a cost-effective, environment friendly as well as a sustainable method for water desalination is required. In this paper, we suggest a novel method that is predicated on monitoring the membrane's electrochemistry, surface atmosphere, and chemical stability. The sol-gel process was used to create the synthetic inorganic nano composite membrane based on PVC. The organic and inorganic matrix boosted the qualities of the membrane such as stability, flexibility, mobility, surface shape, and much more improved electrochemical properties. It is evident that the preparation and use of the hybrid multifunctional nanocoated membrane depend heavily on surfaces, interfaces, and electrochemical parameters. However, the use of the aforementioned nano composite membrane for desalination of hypersaline water will be a remarkable role in terms of reducing environmental stress caused due to water scarcity.

Keywords: *Desalination; sol gel process; nanocomposite membrane; mobility*

Empowering Farmers for Climate-Resilient Agriculture through ICT and Indigenous Knowledge Integration**Himanshu Yadav***Department of Agriculture Extension Communication, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh, India.***ABSTRACT**

Climate change poses a significant threat to smallholder farmers, particularly in vulnerable agro-ecological zones. There is an urgent need for adaptive strategies that are both sustainable and inclusive. Information and Communication Technologies (ICTs) and Indigenous Technical Knowledge (ITK) as a smart agricultural approach to enhance farmers' resilience against climate variability. ICT tools such as mobile apps, real-time weather forecasting, remote sensing, and digital advisory platforms are proving vital in enabling timely decision-making at the farm level.

Simultaneously, indigenous knowledge, rooted in centuries of local experience, offers context-specific solutions for managing soil, water, crops, and biodiversity under changing climatic conditions. The integration of these systems not only bridges the knowledge gap but also respects the socio-cultural realities of farming communities. Through case studies from climate-sensitive regions in Uttar Pradesh, ICT and ITK can together empower farmers to adopt climate-smart practices, reduce risks, and improve livelihood security. Recommendations are provided for extension strategies that blend modern digital tools with grassroots wisdom to ensure climate resilience and farmer empowerment.

Keywords: *Climate Resilience; Smart Agriculture; ICT Tools; Indigenous Knowledge; Farmer Empowerment; Climate-Smart Practices; Digital Extension; Sustainable Farming*

Hydroelectricity Projects in the Himalaya and its Environmental Security Challenges**P J Khache***Department of Defence and Strategic Studies, University of Allahabad, India.***ABSTRACT**

The abundance of rivers and in response to clean energy resources the Himalayan countries are persuaded to tap the hydropower energy. The nature of topography, hydropower potential and the rising energy demand are the factors that have actuated to build the hydroelectricity projects. But there are serious environmental concerns like rapid melting of glaciers, cloud burst, flash floods, landslides etc. And some of the Himalayan states also have serious territorial and water disputes and thereby militarizing and building 'strategic developmental' projects in the region. For several decades, conservationists and scientists have expressed concerns about rapid deterioration of the Himalayan environment. This alarming issue is visible in the forms of disaster and unprecedented river discharge dynamics. Despite the geological instability and the adverse impact of building dams, several countries continue to pursue the development of hydroelectricity project. This article analyzes the impact of hydroelectricity projects in the Himalaya to the environment. In this article, environmental security threats in the Himalaya are viewed as the regional and global security threats and argue that the ambitious hydroelectricity project of the individual state has to be prudently executed.

Unlocking the Health Benefits of Bioactive Phytochemicals**Rekha Vijayvergia and Pratima Vijayvergiya****ABSTRACT**

Bioactive phytochemicals are naturally occurring compounds in plant-based foods that, while not essential nutrients, play a crucial role in supporting human health. These compounds- such as flavonoids, polyphenols, alkaloids, terpenoids, and glucosinolates- exhibit a wide range of biological activities including antioxidant, anti-inflammatory, and antimicrobial effects. Their regular intake has been associated with a reduced risk of chronic diseases such as cardiovascular disorders, type 2 diabetes, certain cancers, and neurodegenerative conditions. This review highlights the diverse nature of bioactive phytochemicals, their primary dietary sources, and their mechanisms of action within the human body. It also explores current scientific evidence on their preventive and therapeutic potential, while addressing the challenges related to bioavailability and individual variability in response. As research progresses, bioactive phytochemicals are becoming central to the development of functional foods and integrative nutrition strategies, positioning them as key agents in the promotion of long-term health and disease prevention.

Keywords: *Antioxidant activity; Bioactive phytochemicals; Functional foods; Human health*

Integrating Nano Biotechnology For Plant Defence Mechanisms and Sustainable Wood Preservation**Ankita Semwal¹, Hukum Singh², Rakesh Kumar³, Ranjana Yadav¹**

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ABSTRACT

Nanoparticles have emerged as highly promising tools for addressing complex issues across diverse scientific and technological fields, including wood science. In particular, metal nanoparticles are recognized for their effectiveness in enhancing wood protection due to their strong antimicrobial activity and capacity to improve the structural durability of wood materials. Nevertheless, traditional methods for synthesizing these nanoparticles are largely chemical, typically associated with high production costs and the release of environmentally harmful by-products. With the rising global demand for timber driven by population growth, the need for sustainable and efficient wood preservation strategies has become increasingly critical in contemporary forestry. Conventional wood preservatives and stress mitigation techniques, however, pose considerable risks to both ecological systems and human health. In this context, plant-mediated green synthesis of metal nanoparticles has emerged as an environmentally benign and economically viable alternative, offering a more sustainable approach to wood protection.

Green synthesis techniques utilize natural resources such as plant extracts, microorganisms, and biomolecules to produce nanoparticles in a cost-efficient and scalable manner. These methods capitalize on the inherent renewability and availability of biological materials, providing an eco-friendly alternative to conventional chemical synthesis. Moreover, bio-inspired synthesis enables precise regulation of critical nanoparticle attributes—including size, shape, and composition—thereby optimizing their performance in wood protection applications. Plant-mediated nanoparticles also exhibit inherent biocompatibility and biodegradability, substantially mitigating the environmental and health

risks often linked to chemically synthesized nanoparticles. This environmentally sustainable approach is particularly valuable in addressing the challenges of toxicity and ecological impact associated with current wood preservation technologies. Incorporating plant-based nanoparticle synthesis into wood protection strategies represents a progressive and sustainable innovation within forest product technology. By improving the durability and biological resistance of wood materials, this method supports the long-term stability of forest ecosystems and aligns closely with the overarching objectives of sustainable forest management.

Keywords: *Green synthesis; metal nanoparticles; plant defense mechanisms; plant extract; wood preservatives*

Methodology

Collection of the plant material.

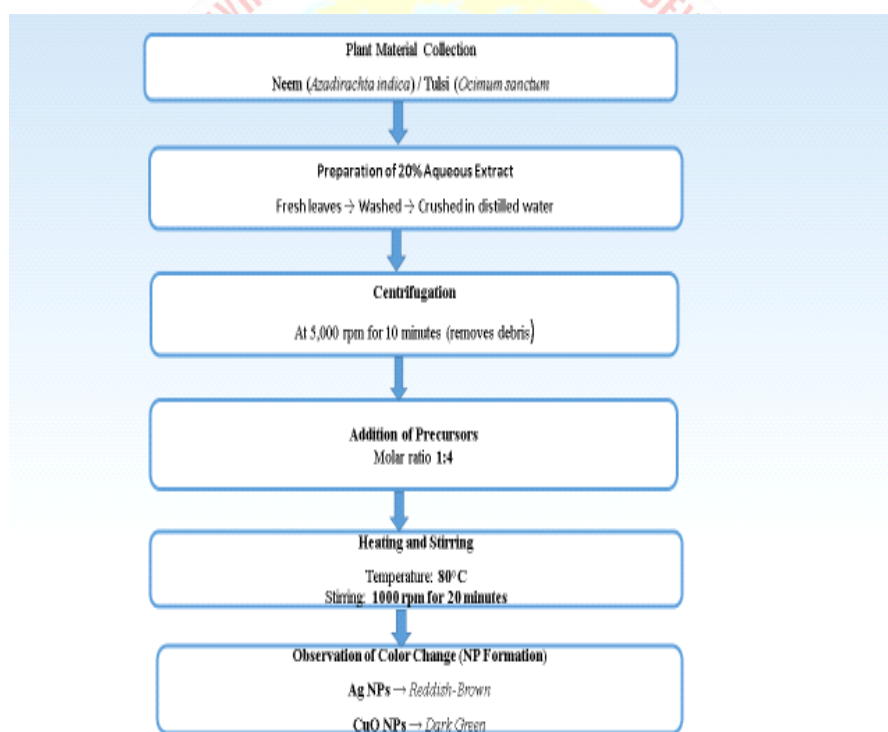
CuO nanoparticles were prepared using plant extracts of *Azadirachta Indica*, based on literature (Khan et al., 2017; Shiny et al., 2019)

Characterization of CuO nanoparticles was done with the help of DLS, UV, FTIR and SEM.

Two methods of treatment were carried out for the study.

Assessing the penetration and retention of green synthesized nanoparticle formulation in wood

Evaluating the efficacy of bio-synthesized nano based formulations against bio-deteriorating agents.



Result

The nano-based formulation was characterized using various analytical techniques. Dynamic Light Scattering (DLS) analysis revealed that the particle size distribution of copper oxide nanoparticles synthesized using *Azadirachta Indica* (Neem) was highly monodisperse, exhibiting a single sharp peak, while zeta potential measurements confirmed the stability of the prepared nanoformulation. Further characterization using Scanning Electron Microscopy (SEM), Energy Dispersive X-ray Analysis (EDAX), and Fourier Transform Infrared Spectroscopy (FTIR) was conducted. SEM analysis showed that the particle size of the synthesized CuO nanoparticles ranged between 136.7 nm and 194.3 nm. The presence of some larger particles was attributed to the natural tendency of CuO nanoparticles to agglomerate due to their high surface energy and surface tension. EDAX analysis, performed in

conjunction with SEM, confirmed the elemental composition and the presence of CuO in the formulation. FTIR spectra of the CuO nanoparticles exhibited characteristic absorption peaks corresponding to functional groups adsorbed on their surface at 3600.610, 3433.396, 2909.643, 2382.818, and 1623.613 cm^{-1} . Additionally, UV–Visible spectroscopy of the biosynthesized CuO nanoparticles demonstrated a strong absorption peak at 340 nm, confirming their optical properties.

Conclusion

It can therefore be concluded that higher concentrations of biologically synthesized nanoparticles derived from *Azadiracta Indica* (Neem) leaves effectively inhibited fungal growth, thereby markedly enhancing their antifungal efficacy. These nanoparticles present a sustainable alternative to conventional chemical treatments and serve as innovative approaches to improve the durability and sustainability of wood-based materials, ultimately contributing significantly to ecosystem conservation.

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Taxonomic Enumeration of Some Fodder Plants in Bilaspur District, Chhattisgarh

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ABSTRACT

The identification and documentation of fodder plants are vital for maintaining sustainable livestock production and ensuring the livelihoods of rural communities. Bilaspur district in Chhattisgarh has rich vegetation that includes a variety of wild and cultivated species used as fodder. The present study focuses on recording and classifying some important fodder plants found in this region. Systematic field surveys were carried out in different habitats to collect and study plant specimens. Each species was identified using standard botanical methods and verified with herbarium records. The work provides details on the botanical names, local names, family, and ecological information of the recorded species. Initial results show that grasses, legumes, and other herbaceous plants form the major part of the fodder resources in the area. This taxonomic listing will serve as a valuable reference for future studies on fodder management, conservation planning, and sustainable livestock practices. Additionally, the study emphasizes the need to protect local plant resources to support traditional animal husbandry in the face of modern agricultural changes.

Keywords: *Fodder plants; Taxonomic study; Bilaspur; Chhattisgarh; Livestock; Conservation*

Home Gardens of Halakki Vakkaliga as Models of Agroecological Sustainability**Rajeshwari N.¹, Nagaratna C. Kurbetta¹ and Sowmya B.N.²**¹*Department of Extension and Communication Management, College of Community Science, UAS, Dharwad, Karnataka, India.*²*Department of Agricultural Extension Education, College of Agriculture, UAS, Dharwad, Karnataka, India.***ABSTRACT**

Halakki Vakkaliga community in Ankola, situated in the ecologically sensitive Western Ghats, contribute significantly to natural resource management and environmental security. Home gardens of this community serve as dynamic agro ecological units, preserving indigenous ecological knowledge while supporting biodiversity conservation and sustainable land use. This study explores the vital role of traditional home gardens maintained by the Halakki Vakkaligas using ecological indices including the Shannon-Weaver Index ($H' = 3.242$) and Simpson's Diversity Index ($1 - D = 0.928$) the research quantifies species richness and evenness, revealing a highly diverse and balanced agro ecological system. Low species dominance ($D = 0.071$; $1/D = 14.07$) further underscores the ecological stability fostered by these practices. Hence it was found that Ankola's humid coastal climate and lateritic soils support a wide array of plant species, including fruit trees (*Musa paradisiaca*, *Mangifera indica*), spices (*Piper nigrum*, *Curcuma longa*), medicinal herbs (*Ocimum tenuiflorum*, *Aloe barbadensis*) and plantation crops (*Cocos nucifera*, *Areca catechu*). These species not only fulfill nutritional and economic needs but also reflect deep-rooted cultural and ecological knowledge. By integrating ethno botanical data with digital tools for documentation and analysis, this study highlights the potential of digital platforms to preserve indigenous practices and inform global conservation strategies. It positions the Halakki home gardens as dynamic examples of community-led resilience, illustrating how traditional knowledge systems can shape sustainable futures in the face of rapid environmental change. The study also underscores the potential of community-based agroforestry models to enhance environmental security. Ultimately, Halakki home gardens emerge as resilient, culturally rooted systems offering valuable insights for climate adaptation and sustainable development.

Keywords: *Agroforestry; Biodiversity; Halakki Vakkaliga; Home gardens***Role of Festivals in Sustaining Community Cohesion during Environmental Change****Rajeshwari N.¹, Sowmya B N² and Nagaratna C. Kurbetta¹**¹*Department of Extension and Communication Management, College of Community Science, UAS, Dharwad, Karnataka, India.*²*Department of Agricultural Extension Education, College of Agriculture, UAS, Dharwad, Karnataka, India.***ABSTRACT**

Karnataka's festivals reflect the rich regional diversity and cultural heritage. Beyond religious observances, these festivals serve as vital platforms for fostering social cohesion, preserving historical memory and sustaining economic livelihoods, particularly in rural and tribal settings. Through ethnographic fieldwork—including in-depth interviews and participatory observation—the research traces how Hegde Jatra and the Suggi Festival function as living archives of local history and adaptive strategies in a changing environment. These festivals emerge as dynamic cultural ecosystems that respond to environmental and socio-economic changes, particularly in the context of increasing climate-related challenges. Hegde Jatra marked by rituals like Kalasha meravanige, Pallakki seva, and Ratha Utsava, engages all age groups in collective devotional practices, thus strengthening intergenerational bonds and cultural continuity. The Halakki Vakkaliga community plays a central role in preserving

intangible heritage through chariot decoration, folk music and storytelling practices rooted in ecological knowledge and seasonal awareness. These traditions function as repositories of historical and environmental memory, passed down orally across generations. The Suggi Festival, a vibrant celebration of agrarian life in Belambra village of Ankola taluk, showcases youth participation through dance rehearsals (Suggi Kunita), crafting of traditional headgear (Turayi) and organizing communal events. Importantly, the festival incorporates contemporary concerns through initiatives like Hagarana, a platform for public awareness on environmental and social issues such as the Shirur landslide, deforestation, mining and the adverse effects of mobile usage. These integrations reflect the community's adaptability and proactive response to climate change and modernization. The study highlights how such festivals serve as resilient cultural frameworks, supporting communities in navigating both historical transitions and present-day ecological and societal threats. Thus study also highlights the active role of elders, women and youth in festival preparations reinforcing a collective identity rooted in shared responsibilities and values.

Keywords: *Climate resilience; Halakki Vakkaligas; Suggi dance; Hegde jatre*

Enhancing Grey Water Treatment Using Constructed Wetlands and Reuse

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Abstract

Greywater, which constitutes a significant portion of household wastewater, is often left untreated in low-resource settings due to the absence of affordable and sustainable treatment technologies. This study investigated the performance of a vertical flow constructed wetland (VFCW) system for treating domestic greywater using locally available materials such as gravel, ceramic brick fragments, and biochar. The system is vegetated with macrophytes like *Typha latifolia* and *Lemna minor*, which support microbial growth and facilitate pollutant uptake. Greywater treatment occurred through a combination of filtration, sedimentation, adsorption, microbial degradation, and plant-based nutrient removal. Laboratory-scale experiments were conducted to evaluate reductions in turbidity, biochemical oxygen demand (BOD), total suspended solids, nutrients, and trace organic micropollutants. The treated effluent consistently met reuse standards for non-potable applications such as landscape irrigation. The integration of biochar in the filter media significantly enhanced pollutant adsorption, contributing to better overall treatment efficiency. These findings demonstrated that engineered VFCW systems can serve as an effective and eco-friendly approach to decentralized greywater management and reuse.

Keywords: *Greywater reuse; constructed wetlands; vertical flow; micropollutants; biochar; life cycle analysis; water conservation*

Introduction

Water scarcity is a pressing global issue, particularly in developing regions where access to clean water is limited (Shemer et al., 2023). Grey water (GW), which accounts for 55–75% of household wastewater, offers a valuable opportunity for reuse if treated effectively (Peprah et al., 2018). Constructed wetlands (CWs) provide an eco-friendly and cost-effective solution by utilizing natural filtration and biological processes (Majid et al., 2025). This study focuses on enhancing the treatment of GW using a vertical flow constructed wetland system integrated with biochar and various aquatic plants.

Objectives

This study aims to enhance grey water treatment efficiency using optimized constructed wetlands by identifying key pollutants, applying chemical and biological treatment, improving reuse potential, conducting life cycle assessment, and developing a cost-effective, environmentally sustainable treatment system.

Methods

The treatment system involves a vertical flow constructed wetland using ceramic bricks, natural aggregates, and biochar produced from agricultural waste. Aquatic macrophytes used include emergent species (*Typha*, *Phragmites*), floating species (*Lemna*, *Eichhornia*), and submerged types. Treatment mechanisms include sedimentation, filtration, microbial degradation, and adsorption. Performance is assessed using standard water quality indicators such as BOD, TSS, COD, and microbial counts.

Results

The system achieved BOD removal exceeding 85%, TSS reduction above 80%, and COD reduction in the range of 65–75%. Incorporating biochar improved COD removal by 10–15% compared to conventional media. Plants such as *Typha* and *Phragmites* contributed significantly to organic pollutant degradation.

Conclusion

This study demonstrates that vertical flow constructed wetlands enhanced with biochar and specific macrophytes offer an effective and sustainable method for treating grey water, enabling its safe reuse for irrigation and other non-potable applications.

Keywords: *Greywater reuse; constructed wetlands; vertical flow; micropollutants; biochar; life cycle analysis; water conservation*

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The Erosion of Healthy Living and Climate Resilience in the Age of Urban and Economic Growth
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ABSTRACT

The pursuit of urban development and economic growth has brought remarkable advancements in infrastructure, technology, and living standards. However, this progress often comes at a significant cost to human health and environmental sustainability. This paper explores the declining standard of healthy life and the disruption of suitable climatic conditions as consequences of rapid urbanization and unchecked economic expansion. Urban development frequently leads to increased pollution, loss of green spaces, and heightened stress levels due to overcrowded and poorly planned living environments. Similarly, economic growth, driven by industrialization and resource exploitation, contributes heavily to greenhouse gas emissions and climate change, resulting in extreme weather events and degraded air and water quality. These factors collectively deteriorate public health, exacerbate respiratory and cardiovascular diseases, and reduce overall life quality. Moreover, vulnerable populations such as children, the elderly, and low-income communities face disproportionate risks. The paper underscores the urgent need for sustainable urban planning, environmentally responsible economic policies, and integrated health-environment frameworks. Emphasis is placed on green infrastructure, renewable energy, public health initiatives, and climate adaptation strategies as essential tools for mitigating the adverse effects of development. Only by harmonizing economic ambitions with ecological balance and human well-being can societies ensure a truly progressive and healthy future.

Keywords: *Urban Development; Economic Growth; Public Health; Climate Change*

Evaluation Of Soil Test Crop Response Equation In Suru Sugarcane Through Fertigation

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EXTENDED SUMMARY

Purpose

The low productivity of sugarcane is due to inadequate and imbalanced use of fertilizers. Soil Test Crop Response (STCR) is the most comprehensive approach of fertilizer application using soil test values, nutrient requirement of the crop, contribution of nutrients from soil, manures, fertilizers and fixing yield targets is possible. Water and nutrients play a very important role in increasing crop productivity. So, precise and judicious use of nutrients and water is important in sustainable agriculture. Fertigation is an efficient technology in modern irrigated agriculture which not only increases yield but also increases fertilizer use efficiency. Fertigation has been found as one of the best way of applying nutrients through the drip irrigation system. Hence, it is necessary to provide the fertilizer application through drip irrigation.

Soil Test Crop Response (STCR) is the most comprehensive approach of fertilizer application using soil test values, manures, fertilizers and fixing yield targets is possible. Fertigation has been found as one of the best way of applying nutrients through the drip irrigation system. In this context, the study aims is to study the effect of STCR based nutrient management through fertigation on yield of sugarcane and residual soil fertility.

Material and methods

The experiment was conducted during 2021-22 to 2022-23 on Inceptisol soil which was laid out in randomized block design consisting seven treatments for Plant cane I, II and ratoon. The treatment comprised of T₁- Absolute control, T₂- Nutrients applied as per general recommended dose of fertilizer, T₃- recommended dose of fertilizer through fertigation (80% of GRDF) and T₄, T₅, T₆ and T₇ were the 80% of nutrient applied as per yield target based fertigation for 150 t ha⁻¹, 200 t ha⁻¹ and 250 t ha⁻¹ for plant cane I and II respectively and for ratoon cane with yield targets were 125 t ha⁻¹, 150 t ha⁻¹ and 175 t ha⁻¹ for the treatments T₄, T₅, T₆, respectively. The following STCR equations were used for evaluating it through fertigation study. The initial soil fertility status of available N, P and K in plant cane I, plant cane II and for ratoon were 198, 21 and 638 kg ha⁻¹, 163, 22 and 773 kg ha⁻¹ and 159, 19 and 616 kg ha⁻¹, respectively.

STCR Yield target equation with FYM (20 t ha⁻¹) for suru Sugarcane

$$FN = (6.60 \times T) - (2.30 \times SN) - (1.69 \times FYM)$$

$$FP_2O_5 = (2.10 \times T) - (8.00 \times SP) - (0.75 \times FYM)$$

$$FK_2O = (2.60 \times T) - (0.38 \times SK) - (1.26 \times FYM)$$

STCR Yield target equation for ratoon Sugarcane

$$FN = (4.47 \times T) - (1.08 \times SN)$$

$$FP_2O_5 = (1.56 \times T) - (2.32 \times SP)$$

$$FK_2O = (3.37 \times T) - (0.64 \times SK)$$

The nutrients were applied as per STCR equation for both plant cane I, II and ratoon as per following fertigation schedule

Weeks after planting	Nutrients %			No. of splits
	N	P ₂ O ₅	K ₂ O	
1 to 4 weeks	15	10	10	4
5 to 9 weeks	35	35	15	5
10 to 20 weeks	50	55	35	11
21 to 26 weeks	--	--	40	6

Sources of Fertilizer:

Conventional Method- Urea, Single super phosphate, Muriate of potash

Fertigation – Urea, Monoammonium phosphate, White Muriate of potash

Result

The pooled results showed that, the application of 80% nutrient source ($465:99:77 \text{ N: P}_2\text{O}_5: \text{K}_2\text{O kg ha}^{-1}$) through chemical fertilizer for suru sugarcane as per yield target of 150 t ha^{-1} with FYM through fertigation and application of 80% inorganic fertilizer dose ($310:121:22 \text{ N: P}_2\text{O}_5: \text{K}_2\text{O kg ha}^{-1}$) for ratoon sugarcane as per yield target of 125 t ha^{-1} were achieved yield target and maintained the soil fertility.

Conclusion

Application of 80% inorganic fertilizer dose ($465:99:77 \text{ N: P}_2\text{O}_5: \text{K}_2\text{O kg ha}^{-1}$) for suru Sugarcane as per STCR yield target 150 t ha^{-1} equation with FYM through fertigation and application of 80% inorganic fertilizer dose ($310:121:22 \text{ N: P}_2\text{O}_5: \text{K}_2\text{O kg ha}^{-1}$) for ratoon Sugarcane as per STCR yield target 125 t ha^{-1} equation achieved 100% yield and economically beneficial amongst different treatments.

Keywords: *Fertigation; soil test crop response; Sugarcane*

Modern Farming and the Decline of Food Quality: A Call for Organic Revival for Health and Sustainability

Subham

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ABSTRACT

In recent decades, the Green Revolution and modern farming technologies have drastically increased food production across the globe. However, this progress has come at a steep cost—compromised food quality and severe health repercussions. The overuse of chemical fertilizers, synthetic pesticides, genetically modified organisms (GMOs), and mono-cropping techniques has degraded soil fertility, reduced the nutritional value of food, and contributed to growing health issues among humans. Numerous scientific studies have associated modern agricultural inputs with increased incidences of chronic diseases such as cancer, hormonal disorders, allergies, gastrointestinal complications, and neurological disorders. Furthermore, this chemically intensive farming system has led to environmental degradation through soil erosion, water pollution, and loss of biodiversity. In contrast, organic farming presents a sustainable and eco-friendly alternative. By avoiding synthetic chemicals and embracing natural practices such as composting, green manuring, crop rotation, and biological pest control, organic farming nurtures the soil, enhances biodiversity, and produces food that is free from harmful residues. This paper critically analyzes the adverse impacts of modern agriculture on food quality and human health, and underscores the importance of transitioning toward organic methods. Through empirical data, case studies, and comparative analysis, the study proposes organic farming as a viable solution to restore food integrity, safeguard public health, and achieve long-term agricultural sustainability. Embracing organic agriculture is not just an environmental strategy—it is a moral responsibility toward future generations.

Keywords: *Organic farming; modern agriculture; food quality; human health; chemical fertilizers; sustainability; public health; soil degradation; environmental impact*

Traditional Weather Forecasting Practices for Climate Change Management**Nagaratna C. Kurbetta, Shobha Nagnur and Geeta Channal***Department of Extension and Communication Management, College of Community Science, UAS, Dharwad, Karnataka, India.***ABSTRACT**

Climate change has become a defining challenge of our time, exerting profound impacts on agriculture. Increasing temperatures, shifting rainfall patterns and the frequency of extreme weather events pose significant threats to agricultural productivity and food security. Farmers/farm women, especially in regions with diverse agro-climatic conditions like Karnataka, are facing unprecedented challenges as they strive to adapt to these changes. In this context, traditional weather forecasting practices have emerged as a crucial resource for managing agricultural risks. This study focuses on documenting and analyzing the traditional weather forecasting practices employed by farm women in four distinct agro-climatic zones of Karnataka: the Northern Dry Zone (NDZ), the Northern Transition Zone (NTZ), the Hilly Zone (HZ), and the Coastal Zone (CZ). The study findings highlight how farm women interpret the behavior of ants, cattle, fish, and termites, as well as the blooming patterns of plants to anticipate weather changes. Celestial observations, such as the halo around the moon and the brightness of stars, are also used to predict rainfall. Additionally, cloud formations and specific wind patterns like the Harischandra and Kumbar winds serve as indicators of monsoon arrival or delay. Other traditional indicators include soil cracking, water levels in ponds and wells, and changes in sea and river levels. Despite the increasing unpredictability of weather due to climate change, these traditional methods remain integral to the resilience of farming communities. However, the study also underscores the need to integrate indigenous knowledge with modern climate science to enhance the effectiveness of adaptation strategies. This research provides valuable insights into the continued relevance of traditional weather forecasting practices in ensuring sustainable agricultural livelihoods amidst evolving climatic conditions.

Keywords: *Climate change; Indigenous Technical Knowledge; Farm women; Weather forecasting*

Climate Change and Gender: A Review on Gendered Perspectives on Climate Change**Nagaratna C. Kurbetta¹ and Rajeshwari N¹ and Soumya B. N.²**

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ABSTRACT

Climate change is an increasingly urgent global issue, posing complex and interconnected challenges that cut across environmental, economic, social, and cultural dimensions. Among these, gender is a critical yet often overlooked factor. Women and men experience and respond to climate change impacts in different ways, influenced by unequal access to resources, decision-making power, and livelihood opportunities. This review article examines the gendered implications of climate change, with a focus on rural and agrarian communities in South Asia. Drawing from empirical studies conducted in varied ecological and cultural contexts—such as the arid regions of Rajasthan, the Himalayan landscapes of the Upper Ganga Basin, the Melamchi watershed in Nepal, and the flood- and drought-prone zones of Bihar this paper synthesizes how gender roles shape vulnerability, resilience, and adaptation strategies. It reveals that women often bear a disproportionate share of climate-induced burdens due to their roles in water collection, subsistence farming, and household management. Male out-migration further shifts responsibilities onto women, leading to the feminization of agriculture without a corresponding increase

in their access to land, credit, or extension services. The article highlights not only the vulnerabilities faced by women but also their agency and innovation in coping with environmental stress. Women employ a range of adaptive practices—from indigenous water conservation methods to diversified livelihood strategies—but their efforts often remain invisible or unsupported by formal institutions. Case studies emphasize the importance of inclusive adaptation and mitigation policies that actively engage women and address systemic inequalities. In conclusion, the review underscores the need for gender-sensitive climate strategies that recognize women as active stakeholders rather than passive victims. It calls for intersectional approaches, improved data collection, capacity building, and policy reforms that integrate gender equity into climate resilience planning. Addressing these gaps is essential for achieving sustainable development and climate justice.

Keywords: *Climate change; Gender vulnerability; Adaptation; mitigation*

Evaluation of Advanced Sesame Genotypes in the Arid Plains of Western Rajasthan for Developing Climate-Resilient Varieties

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ABSTRACT

Sesame (*Sesamum indicum* L.), popularly known as the "queen of oilseeds" holds significant importance among oilseed crops due to its high oil content, nutritional value, and medicinal properties. India ranks among the top sesame-producing countries, with Rajasthan's western arid and semi-arid zones contributing notably to its cultivation. In the present study, 40 advanced sesame genotypes along with standard checks viz., RT 372, RT 54, TKG 22, and GT 10 were evaluated during Kharif 2024 at the Research Farm of Dr. B.R. Choudhary Agricultural Research Station, Mandor (Latitude 26°15' to 26°45' N, Longitude 73°00' to 73°29' E, and Altitude 242.6 m). The experimental site had loamy sand soil, and the trial was laid out in a Randomized Block Design (RBD) with three replications. Among the evaluated genotypes, RMT 695, RMT 705, RMT 708, and RMT 711 exhibited significantly superior performance over the best check RT 372. These promising genotypes may serve as potential parents in future sesame breeding programmes aimed at enhancing yield and adaptability.

Keywords: *Sesame; Advanced Genotypes; Arid Western Plain; Climate-Resilient Varieties*

In-vitro efficacy of systemic, non-systemic and combi-fungicides against *Alternaria porri* causing purple blotch of onion.

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ABSTRACT

Purple blotch of onion, incited by *Alternaria porri*, poses a serious threat to onion cultivation, significantly impacting both yield and bulb quality. The present study was conducted to evaluate the **in vitro efficacy** of different categories of fungicides—**systemic, non-systemic, and combi-fungicides**—against the most virulent isolate (ChAp1) of *A. porri*, using the poisoned food technique on PDA medium.

Systemic fungicides (seven in total) were tested at 500 and 1000 ppm. Four fungicides—**Propiconazole, Hexaconazole, Difenconazole, and Tebuconazole**—completely inhibited fungal mycelial growth (0.00 mm) and achieved **100% inhibition** at both concentrations. These treatments were statistically at par and significantly superior over others. **Pyraclostrobin** exhibited 90.03% and 90.92% inhibition at 500 and 1000 ppm, respectively, while **Thiophanate methyl** recorded 72.40% and 83.51% inhibition. **Azoxystrobin** was the least effective among systemic fungicides, showing **62.40%** inhibition at 500 ppm and **70.18%** at 1000 ppm.

Non-systemic fungicides (seven in total) were evaluated at 2000 and 2500 ppm concentrations. The most effective were **Copper hydroxide** (93.14% and 94.06%), **Mancozeb** (90.92% and 93.14%), and **Dinocap** (89.07% and 90.23%). Other effective treatments included **Propineb** (85.55% and 87.03%) and **Copper oxychloride** (83.51% and 88.14%). **Thiram** was the least effective, showing **69.81%** inhibition at 2000 ppm and **77.59%** at 2500 ppm.

Combi-fungicides (seven combinations) were also tested at 2000 and 2500 ppm. **Captan 70% + Hexaconazole 5%** showed **100% inhibition** at both concentrations, outperforming all other treatments. This was followed by **Trifloxystrobin 25% + Tebuconazole 50%** (92.58% and 93.14%), **Hexaconazole 4% + Zineb 68%** (91.12% and 91.14%), and **Thiophanate methyl 45% + Pyraclostrobin 5%** (89.81% and 91.12%). The least effective among the combinations was **Metiram 50% + Pyraclostrobin 5%**, with inhibition rates of **86.48%** and **88.51%**, respectively.

The study conclusively demonstrated that among all fungicides tested, **Captan + Hexaconazole**, **Propiconazole**, **Copper hydroxide**, and **Mancozeb** are the most effective in suppressing *A. porri* under in vitro conditions. These results are in agreement with previous studies and offer a valuable reference for integrated disease management of purple blotch in onion crops.

Suggestion to overcome the challenges faced by Cotton Growers in Vidarbha in Adoption of Improved Integrated Management Practices of Pink Bollworm

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ABSTRACT

Maharashtra is an important cotton growing state in India. Cotton yield primarily depends on weather, pest, diseases and management practices. Pink bollworm (PBW) is one of the major damaging insect pests of cotton. In Vidarbha region, cotton is the most important cash crop grown. The impact of PBW attack has been felt the most in regions of vidarbha where cotton is cultivated as the main cash crop. Present study was conducted to ascertain suggestions from cotton growers to overcome various constraints faced by them in adoption of improved integrated management practices of pink bollworm in six districts on the basis of maximum area under cotton cultivation of Vidarbha region in Maharashtra, namely Buldana, Akola, Amravati, Yavatmal, Wardha and Nagpur. The major suggestions expressed by the cotton growers to overcome challenges faced in adoption of improved integrated management practices of pink bollworm were (96.00%) of them expressed availability of biofungicides *Beauveria bassiana* should made available at subsidized rate nearby market, followed by availability of recommended insecticides should made available at subsidized rate in nearby market (94.33%), the government should made available good quality pheromone trap and lure used for pink bollworm at village level (93.00%), credit facilities should be increased and process should also easy and quick (87.33%) free distribution of publications about improved integrated management practices of pink bollworm should be provided (79.00%), the government check should be increase on insecticides dealer to sell appropriate insecticides (67.33%), availability of trichocards should be made at village level (66.66%), demonstration should be organized by extension agencies on installation of pheromone traps, application of yellow sticky traps (50.33%) and about identification of “rosette-bloom or rosette – flower”, removal of rosette flower and destruction of larva (36.66%), knowledge should be provided on preparation of insecticides solution and proper precautions should be taken during application of insecticides (35.00%) availability of sprayer pump should made available through custom hiring centre at village level (17.66%).

Effect of Direction of sowing and Phosphorus levels on growth and yield attributes of Toria (*Brassica campestris* L.)**Amal Vijay V S, Akankhya Pradhan, Kumar Raj, Rajesh Singh***Department of Agronomy, Naini Agricultural institute, SHUATS, Prayagraj, U.P., India.***EXTENDED SUMMARY****Abstract**

A field experiment was conducted during Rabi season 2024 at Crop Research Farm, Department of Agronomy, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (U.P.) on Toria. The soil of experimental plot was sandy loam in texture, low in organic carbon (0.72%), nearly neutral in soil Ph (7.2), Nitrogen (178.48 kg/ha), Phosphorous (27.80 kg/ha), Potassium (233.24 kg/ha). The treatment consist of Direction of sowing (North - South, East - West, Control (NW - SE)) and Phosphorus (50, 60, 70 kg/ha) levels. The experiment was carried out in a randomized block design with ten treatments and were replicated thrice. The results revealed that significantly higher plant height (167.50cm), Number of Branches/plant (15.87), dry weight (31.10 g/plant), number of Siliqua/plant (222.40), number of seeds/Siliqua (19.40), were obtained in East West Direction of sowing and application of Phosphorus at 60kg/ha in Toria crop.

Keywords: *Toria; Direction; Growth; Yield attributes***Introduction**

Toria (*Brassica campestris* L. var. Toria) belongs to Cruciferae family is major oilseed crop in India. It occupies a prominent place after groundnut in both area and production by meeting the requirement in India.. Toria is also known as sarson, rai or raya, lahi. It is a tropical as well as temperate crop and required cool and dry weather for their proper growth. In India, it is grown in rabi season from September-October to February–March. India is the fourth largest oilseed economy in the world. Among the seven edible oilseeds cultivated in India, rapeseed-mustard contributes 28.6% in total oilseeds production and ranks second after groundnut sharing 27.8% in Indian oilseed economy (**Shekhawat et al.2012**). It is estimated that 58 million tons of oilseeds will be required by the year 2020, wherein the share of rapeseed-mustard will be around 24.2 million tons. Crop can be raised well under both irrigated and rainfed condition.

The Toria crop is sown irrespective of row direction. It is mainly sown by broadcast method and the plants are unable to capture the radiant energy fully and thus, cannot make the best use of light. To intercept the solar energy whole day, bidirectional method of sowing has given the best results than Uni (E-W) and Uni (N-S) direction of sowings (**Jagjeewan et al. 2018**). The changes in biomass production of Indian mustard in different directions of sowing are due to the changes of actual evapotranspiration (AET), water use efficiency (WUE), and radiation interception differently in different direction of sowing. (**Jha et al. 2012**)

Phosphorus (P) is the second major essential nutrient element for crop growth and good quality yield. The most obvious effect of P is on the plant root system. Phosphorus is critical in plant metabolism which plays an important role in cellular energy transfer, respiration, photosynthesis. It improves seed size, stimulates proper seed filling and increases oil content. Due to the important role played by P in the physiological processes of plants, application of P to soil deficient in this nutrient leads to increase in yield. (**Devi et.al.,2022**)

Material And Methods

The experiment was conducted during the Rabi season 2024, at the Crop Research Farm, Department of Agronomy, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences (SHUATS), Prayagraj (U.P.). The experiment was conducted in Randomized Block Design with 10 treatments each replicated thrice. The plot size of each treatment was 3m x 3m. The factors are Direction of sowing (North – South, East – West, control (NW - SE)) and Phosphorus (50kg/ha,60

kg/ha, 70 kg/ha). Toria variety PT - 303 was selected for sowing. Seeds were sown in line manually. Seeds were covered with the soil immediately after sowing. The Toria crop was sown on 01 oct 2024. Harvesting was done by taking 1m² area from each plot. And from it five plants were randomly selected for recording growth and yield parameters. The observations were recorded for plant height, Number of Branches/plant, dry weight, number of siliquae/plant, number of seeds/siliqua, test weight, seed yield and stover yield. The data was subjected to statistical analysis by analysis of variance method.

Results And Discussion

Plant height (cm):

At 80 DAS, maximum plant height (167.5 cm) was observed in treatment T5 (East - West + Phosphorus 60 kg/ha). However, treatment T2 (North - South + Phosphorus 60 kg/ha) was found to be statistically at par with treatment T5.

Number of Branches/plants

At 80 DAS, maximum number of branches (15.87) was observed in treatment T5 (East - West + Phosphorus 60 kg/ha). However, treatment T7 (control (NW - SE) + Phosphorus 50 kg/ha) was found to be statistically at par with treatment T5.

Plant dry weight (g):

At 80 DAS, highest plant dry weight (31.10 g/plant) was observed in treatment T5 (East - West + Phosphorus 60 kg/ha). However, treatment T2 (North - South + Phosphorus 60 kg/ha) and treatment T9 (Control (NW - SE) + Phosphorus 70 kg/ha) were found to be statistically at par with treatment T5.

Number of Siliquae/plants

The data shown that there was a significant effect among treatments. However, highest number of siliqua/plant (222.40) was observed in treatment T5 (East - West + Phosphorus 60 kg/ha). However, treatment T3 (North - South + Phosphorus 70 kg/ha), treatment T8 (Control (NW - SE) + Phosphorus 60 kg/ha) and treatment T2 (North - South + Phosphorus 60 kg/ha) were found to be statistically at par with treatment T5.

Number of Seeds /siliquae

The data shown that there was a significant effect among treatments. However, highest number of seeds/siliqua (19.40) was observed in treatment T5 (East - West + Phosphorus 60 kg/ha). However, treatment T6 (East - West + Phosphorus 70 kg/ha) and treatment T1 (North - South + Phosphorus 50 kg/ha) were found to be statistically at par with treatment T5.

Discussion

Plants have a natural tendency to grow towards light sources. plant stand at maturity, plant height, siliquae/plant, seeds/siliqua and 1,000-seed weight, due to better light interception leading to prolonged photosynthetic activity in former as compared to earlier. Planting direction, particularly East-West orientation, can significantly impact plant dry weight by influencing light interception and overall biomass accumulation, leading to higher dry matter yields compared to North-South orientations. (Jha et.al.2015). Phosphorus plays a crucial role in plant growth, including plant height, and its deficiency can lead to stunted growth and reduced plant height. Adequate phosphorus promotes healthy root and shoot growth, leading to taller and stronger plants. Root development, stalk and stem strength, flower and seed formation, crop maturity and production, crop quality, and resistance to plant diseases are the attributes associated with phosphorus nutrition. (Rana et.al.2005)

Conclusion

It is concluded that East-West Directional sowing along with application of Phosphorus at 60 kg/ha was observed higher growth and yield attributes in Toria.

In silico evaluation of phytochemicals from Swertia chirayita Buch. Hams ex Wall an endangered medicinal plant**Garima Kumari¹, Ashish Kumar Guleria² and Jasmeen Kaur³**¹SOAB, COA, PAU, Punjab, India.²Department of Chemistry, Chandigarh University, Punjab, India.³Department of Vegetable Science, PAU, Punjab, India.**ABSTRACT**

Swertia chirayita is one the most valuable medicinal herb that is native to Himalayas, known for its wide use and applications in different medicinal systems to cure certain ailments. Chirata is known for its bitterness that may attributed to presence of certain phytoconstituents like chiratin, amarogentin and ophelic acid etc. Regular oral consumption founds very effective liver tonic. As per reports in China the roots of Swertia generally consumed as a food supplement. Moreover, extracts from different parts of the plant generally used as a cure for a number physiological disorders such as constipation, malaria, diabetes, skin diseases and anemia. Swertia chirata observed with richness in several alkaloids as well as polyoxygenated xanthenes whose medicinal attributes explored to a certain level only and needs more exploration to come up with some new findings that will really helps to conserve the potential of the plant. Excessive exploitation of the natural sources of Swertia chirata and the special environmental requirements that effect its seed germinability has led to drastic reduction in its availability. So, we standardized the propagation potential of the plant and along with this also studied its metabolic profile engineered through valuable techniques. Highest per cent amarogentin content noted was in flowering stage of seedling raised plants (0.4593%). Presence of amarogentin may increases pharmaceutical value of the raised plants. The present study aims to evaluate the action of phytochemicals present in Swertia and their importance in promoting good human health. This study also demonstrates the abundant potential of extracted Swertia natural products for developing herbal medicines towards medical cure.

Keywords: amarogentin; endangered; flavonoids; in silico; phytochemicals; Swertia

Table. Effect of Direction of sowing and Phosphorus levels on growth and yield attributes of Toria

S No	Treatment combinations	Plant height	Plant dry weight	Number of Branches/plant	Number of Siliquae/plant	Number of seeds/silique
1.	North-South + 50 kg/ha P	154.26	25.18	13.53	205.47	18.53
2.	North-South + 60 kg/ha P	163.93	25.93	14.33	216.53	18.40
3.	North-South + 70 kg/ha P	162.97	30.41	13.60	219.40	18.20
4.	East-West+ 50kg/ha P	159.35	25.82	14.00	216.20	18.00
5.	East-West + 60 kg/ha P	167.50	31.10	15.87	222.40	19.40
6.	East-West + 70 kg/ha P	160.87	27.68	14.47	207.87	19.07
7.	Control (NW - SE) + 50 kg/ha	159.82	26.08	15.07	199.13	18.13
8.	Control (NW - SE) + 60 kg/ha	157.63	27.60	14.40	217.20	17.73
9.	Control (NW - SE) + 70 kg/ha	163.51	30.28	13.53	197.33	18.40
10.	Control (N:P: K – 60:30:30 kg/ha)	155.95	27.59	14.87	196.20	17.47
	S. Em (±)	2.05	1.02	0.39	3.05	0.35
	CD (p = 0.05)	6.10	3.05	1.18	9.06	1.04

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Space applications: remote sensing and gis in climate change impacts and solutions

Somya

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ABSTRACT

Climate change poses one of the most pressing global challenges, with far-reaching impacts on ecosystems, weather patterns, sea levels, and human livelihoods. The use of space-based technologies, particularly Remote Sensing and Geographic Information Systems (GIS), has revolutionized the way scientists monitor, assess, and respond to these changes. Remote sensing provides continuous, synoptic, and multi-spectral data from satellite and airborne platforms, enabling the detection of shifts in land use, vegetation cover, glacial retreat, sea-level rise, and atmospheric changes with high temporal and spatial resolution. GIS complements remote sensing by allowing the integration, analysis, and visualization of spatial and temporal data to assess vulnerability, model climate scenarios, and support decision-making.

Together, these tools facilitate the monitoring of greenhouse gas emissions, tracking of extreme weather events, identification of climate-sensitive zones, and implementation of adaptive strategies. Applications include precision agriculture, disaster risk reduction, urban planning, forest and water resource management, and early warning systems. As climate change continues to accelerate, the synergy between remote sensing and GIS offers robust solutions for climate impact assessment and mitigation planning, supporting evidence-based policies and sustainable development goals. Future advancements in satellite technology, data analytics, and AI integration will further enhance the role of space applications in addressing the global climate crisis.

Deep Learning Approach for SPEI-Based Drought Prediction across Multiple Time Scales in Dharwad district of Karnataka**Parvathi S. K.¹, Ashalatha K. V.¹ and Huchesh Budihal²**¹*Department of Agricultural Statistics, College of Agriculture, University of Agricultural Sciences, Dharwad, Karnataka, India.*²*Department of Statistics, S B Arts and K C P Science College, Vijayapura, Karnataka, India.***ABSTRACT**

Drought is a recurring climatic hazard that significantly affects agricultural productivity and water availability. This study presents a deep learning-based framework for developing drought prediction models using the Standardized Precipitation Evapotranspiration Index (SPEI) at multiple time scales (1, 3, 6, 9, and 12 months). Using monthly temperature and precipitation data for the Dharwad district of Karnataka from 1980 to 2024, potential evapotranspiration (PET) was estimated via the Thornthwaite method, and SPEI was subsequently computed. Long Short-Term Memory (LSTM) neural networks were trained separately for each timescale to forecast future SPEI values. Model evaluation was conducted using performance metrics such as mean squared error (MSE), root mean squared error (RMSE), mean absolute error (MAE), and coefficient of determination (R^2). In addition, binary classification of drought events was performed to evaluate detection accuracy using confusion matrix metrics, including accuracy and F1-score. Results indicated that the models performed well in forecasting SPEI values, with the SPEI-6 model achieving the best prediction and classification performance. The results highlight the potential of LSTM-based models in predicting meteorological droughts across varying temporal scales, contributing to improved drought preparedness and management strategies.

Keywords: *Drought; SPEI; LSTM; Deep Learning***Barriers to Empowerment: An Analysis of Challenges Faced by NRLM-Linked SHGs****Pooja Goswami, Arpita Sharma Kandpal***Department of Agricultural Communication, G. B. Pant University of Agriculture and Technology, Pant Nagar, Udham Singh Nagar, Uttarakhand, India.***ABSTRACT**

The National Rural Livelihood Mission (NRLM) has emerged as an initiative aimed at empowering rural women through establishing and assisting the Self Help Groups (SHGs). Despite its comprehensive objectives and structured implementation, many women SHG members continue to face multiple constraints that hinder their participation and empowerment. The key challenges faced by women SHG members linked to NRLM in Pauri Garhwal and Udham Singh Nagar districts of Uttarakhand were identified and analyzed in this study.

A total of 162 women SHG members were selected as respondents. Data were collected through a structured interview schedule, and the Garrett Ranking Technique was employed to prioritize the constraints based on respondents' rankings. The analysis revealed that lack of financial literacy emerged as the most significant barrier, indicating a critical gap in women's ability to understand and manage the financial matters effectively. Lack of proper knowledge about the NRLM programme was ranked second most significant constraint, reflecting inadequate awareness and information dissemination. This was followed by lack of time to participate in SHG activities pointing to competing domestic responsibilities and indicating that rural women had less time for themselves. Interestingly, lack of support and cooperation from family was identified as the least ranked constraint, suggesting a positive shift in household attitudes towards women's participation in SHGs.

The findings highlight the need for focused interventions in financial education, information dissemination, and time management assistance. Strengthening these areas can significantly enhance the impact of NRLM and contribute to sustainable women empowerment in rural areas. The study offers valuable insights for policymakers, practitioners, and extension workers to refine existing strategies and ensure inclusive development through SHGs.

Keywords: *Constraints; financial literacy; information dissemination; women empowerment*

Evaluating Business Performance of Dairy Enterprises in Kittur Karnataka, India: A Regional Study

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EXTENDED SUMMARY

Purpose

Livestock is backbone and livelihood of both rural and urban masses in the globe. In India livestock employs about 8.8 percent of the entire population and dairy alone provides a livelihood of about 70 million farm families. Livestock contributed 16 per cent to the income of small farm households as against 14 per cent for all rural households during 2020-21. Demand for feed and enhanced genetic features may provide opportunities for increased trade which in turn, results in rising milk production costs and lower prices to producers for their poor milk quality. In such a scenario, it is worth exploring whether buffalo or cow-milk production is profitable for farmers. In this context, seeking details on the costs of milk production and the returns from milking is a significant feature. Calculating the financial feasibility of dairy enterprises in Karnataka is crucial for assessing the economic viability and long-term sustainability of investments in the sector. It helps farmers and policymakers to understand the potential returns, risks and payback period associated with dairy operations. This evaluation supports informed decision-making regarding resource allocation, credit access and scaling strategies.

Material and Methods

The Kittur Karnataka region, which comprises seven districts—Bagalkote, Belagavi, Dharwad, Gadag, Vijayapura, Haveri and Uttara Kannada. The present study is based on primary data. The primary data were collected using a well-designed and comprehensive schedule exclusively prepared for the study. The sample dairy farmers were selected using snowball sampling method. A multistage sampling procedure was employed for the selection of the district, talukas and villages. Belagavi, Bagalkot and Uttara Kannada districts were selected based on highest number of dairy animals. Athani and Gokak talukas were selected from Belagavi district, Jamakhandi and Mudhol talukas were selected from Bagalkot district and Sirsi and Honnavar talukas were selected from Uttara Kannada district. From each selected taluka three villages were selected randomly. The talukas were selected based on highest number of dairy animals. The dairy enterprises were selected from these talukas. Number of milch animals in each household was the selection criterion for selecting farming households. The data were obtained from small (1-3 animals), medium (4-10 animals) and large (>10 animals) herd size category farmers through personal interview. Thus, total 135 milk producer households were distributed as small, medium and large herd sized category households. 45 dairy farmers were selected from each category farmers and 15 farmers from each district for small, medium and large category farmers. Budgeting technique, financial feasibility analysis and ratio analysis techniques were used to analyse the data.

Results

The study analyzed the business performance of dairy enterprises in Kittur Karnataka, focusing on cost structures, returns, financial feasibility and ratio analysis across small, medium and large units. Total

annual costs per unit were highest in large units (₹4.51 lakh), with variable costs forming 86.75 per cent of total costs, dominated by feed and fodder (57.56%). Net returns per litre were highest in large units (₹12.39), confirming economies of scale. Financial indicators like NPW (₹54,953/animal), IRR (44%) and BCR (1.35) were also most favorable in large units, with a payback period of 2.6 years. Ratio analysis showed improved efficiency, profitability and solvency with scale, reinforcing that larger units benefit from better resource use, cost control and financial viability.

Conclusions

The study concludes that profitability, efficiency and financial viability of dairy enterprises improve with increased herd size. Large units benefit from economies of scale, better feed management and lower per-unit costs, resulting in higher net returns and investment feasibility. Though small and medium units are viable, their lower margins highlight the need for policy support. As feed and fodder form the largest variable cost, subsidized distribution and bulk procurement of quality feed are recommended. Investment in shared infrastructure for processing, storage and transport, along with training in cost-effective practices and herd management, can boost productivity and operational efficiency, enhancing the overall sustainability of India's dairy sector.

Keywords: *Dairy enterprise; financial feasibility; net returns; benefit cost ratio; ratio analysis and profitability analysis*

Role of exogenous GAs in mitigating cold stress in Bambusa tulda

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EXTENDED SUMMARY

Abstract

Temperature is one of the major factor that delineates plants geographical distribution. Temperature below optimum level is likely to cause chilling and freezing stress.

Several signalling pathways are activated in response to cold stress that ultimately helps in mitigating cold stress. Gibberelin signalling in one such pathway that gets activated in response to cold.

In order to study role of exogenous GAs in mitigating cold stress in Bambusa tulda, a 30 days experiment was conducted where 1 year old plants of Bambusa tulda were kept in cold chamber and foliar spray of 50mg/l gibberelin (GAs) was given. Also some of them were kept under ambient temperature and foliar spray of 50mg/l of gibberlin was given. Various morphological and biochemical parameters were recorded to compare the response of GAs treated and non - treated plants.

Non -treated plants kept under cold stress showed significant effect of cold and were not able to survive upto 30 days. However GAs treated plant kept under cold stress didn't showed any significant increase in morphological factors but they were able to survive and showed increase in biochemical parameters such as proline and total sugars. This confers the role of exogenous GAs in enhancing the survival of plants under cold stress.

Keywords: *Temperature; Cold; Gibberelin; Stress physiology; Survival*

Objectives

To study the impact of various cold treatment in Bambusa tulda.

To study morphological, biochemical response of foliar gibberellin in mitigation of cold stress in Bambusa tulda.

Methodology

Experimental Set-up

One year old plants of Bambusa tulda were taken for 3 different temperature treatment to find the best possible temperature condition for further experiment.

In the later experiment two batch of plants of Bambusa tulda were selected. One was kept at ambient temperature as control, while the other batch was kept at 10°C for cold treatment. Replicates of each treatment were taken. The experiment was conducted for one month. 50mg/l of gibberelins and paclobutrazol were applied foliar for 5 consecutive days before the onset of cold stress. Foliar spray was also given in between the ongoing cold treatement. Application timing was in the evening hours to maximize absorption. Various morphological parameter such as plant height, internodal length and leaf count were assesed. Also,several biochemical parameters such as total chlorophyll, total sugar, total phenol and proline were studied at three key time points:

Day 0: Initial data collection, start of experiment. Day 15: Assessment after 15 days of treatment.

Day 30 : Final data collection after 30 days, representing the end of the experiment.

Fig: experiment set up showing plants kept at ambient temperature conditions and cld temperature conditions.

Treatments:

Control (ambient temperature conditions)	Cold treatment (10°C)
Control with no chemical treatment	Cold stress with no chemical treatment
Control + 50mg/l paclobutrazol	Cold stress + 50mg/l paclobutrazol

Results

In the first ewxperiment, plants kept at 5 °C were not able to survive and showed retarded growth as compared to plants kept at 10°C and 15°C. on the basis of this experiment 10°C temperature was selected for further studies.

In the second experiment plants treated with 50mg/l of GA3 and kept at 10°C cold conditions showed better survival then control and were found toi be more resistant than the contorl plants.

Conclusion

It was concluded that GAs can effectively ameliorate stress conditions in Bambusa tulda and help them to enhance tolerance under cold conditions.

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CRISPR/Cas9-Mediated Engineering of Haploid Inducer Lines in Rice via Targeted Editing of OsMATL and OsPLD1

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ABSTRACT

Doubled haploid breeding is a pivotal strategy in plant breeding, enabling the accelerated production of homozygous lines that would otherwise take several generations to develop. Maize naturally possesses a haploid inducer stock that is widely used at commercial scale, with key regulatory genes identified as ZmMATL, ZmDMP, and ZmPLD3. To enhance rice breeding, this study aimed to create a similar haploid inducer system in rice. Through BLAST searches, phylogenetic comparisons, and expression profiling, OsPLD1 was identified as the putative rice orthologue of ZmPLD3. Meanwhile, OsDMP1 and OsDMP2 were considered potential orthologues of ZmDMP, but due to low sequence similarity and minimal expression, these genes were not pursued further. The study focused on editing OsMATL

and OsPLD1, using four sgRNAs cloned into the vector pRGEB32 and introduced into *Agrobacterium* strain EHA105. Transgenic plants were generated from embryogenic calli derived from rice seeds via standard transformation and selection procedures. PCR analysis showed that 69% of the regenerated plants had integrated T-DNA, while sequencing revealed that 19.5% of these were successfully edited. Observed mutations included both transitions and transversions as well as insertions. Frameshift mutations in OsMATL led to premature translation termination and gene knockdown. In contrast, substitution mutations in OsPLD1 resulted in missense and silent mutations. Once these edits are fixed in the homozygous state, the lines will be evaluated for their haploid induction capability through hybridization with wild-type rice plants.

Keywords: *Doubled haploid; Expression analysis; Haploid inducer stock; Mutations; Orthologue*

Synergistic Role of *Galleria mellonella* Larvae and Gut Microbiota in the Biodegradation of Synthetic Plastics

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ABSTRACT

Plastic pollution has emerged as a critical global threat, disrupting ecological balance, harming wildlife, and posing risks to human health. Among the unconventional biological candidates for plastic degradation, *Galleria mellonella* larvae, known for their natural ability to metabolize beeswax, have demonstrated a unique aptitude for consuming synthetic polymers such as polyethylene (PE) and polystyrene (PS), likely due to structural similarities in their chemical compositions. This study investigated larval physiological responses and gut microbiome dynamics under varying dietary conditions to assess the mechanisms behind plastic degradation. Larvae exhibited stunted growth when fed on plastic substrates compared to those on traditional diets, indicating limited nutritional value. High-throughput 16S rRNA gene sequencing revealed significant shifts in gut microbial communities across diets, with *Enterococcus* spp. dominating in PE- and PS-fed larvae, whereas *Rhodothermus marinus* and *Pyrodictium delaneyi* were associated with non-plastic-fed groups. To evaluate microbial contributions to degradation, four gut-derived bacterial isolates (GM15–GM18) were cultured and assembled into a microbial consortium, which degraded PE sheets by approximately 1.8% over 30 days at 31 °C, as confirmed through Scanning Electron Microscopy (SEM). Furthermore, larvae treated with broad-spectrum antibiotics were analyzed using Gas Chromatography–Mass Spectrometry (GC-MS) to explore microbiome-independent plastic degradation. Metabolites found in the larval frass, such as long-chain hydrocarbons including hexadecane and heptadecane, indicated partial depolymerization of PE even in the absence of native gut flora. Comparative analyses of metabolomic profiles and larval physiology revealed distinct changes between treated and control groups. These results suggest a synergistic mechanism between the larvae and their gut microbiota, offering valuable biological insights into plastic depolymerization. Such findings pave the way for sustainable biotechnological solutions aimed at mitigating the environmental burden of plastic waste through nature-inspired innovation.

Keywords: *Plastic biodegradation; Gut microbiota; *Galleria mellonella*; Polyethylene depolymerization; Microbial consortium*

Resource-Poor to Agripreneurs: A Gender-Inclusive Approach to Livelihood Transformation by SHGs**Rohan Prasad Gupta and Kalyan Ghadei***Department of Extension Education, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, India.***ABSTRACT**

The empowerment of resource-poor rural women through sustainable agripreneurship is central to achieving inclusive rural development. This study presents the **Gender-Sensitive Community-Based Agripreneurship**, a dynamic and replicable framework designed to promote entrepreneurship among women using **livestock and fisheries technologies**. Validated across **22 villages in 6 districts of Odisha**, emphasizes collective empowerment, skill development, market linkage, and social inclusion through a convergence of actors and actions at the grassroots level. The model follows a structured process beginning with **technology mapping**, followed by the **identification of potential women entrepreneurs** and **assessment of constraints, resources, and aspirations**. Key actors include ICAR institutions, KVKs, line departments, NGOs, financial institutions, and SHGs/FPOs. The approach involves **capacity building, enterprise development training, custom hiring centers**, and the establishment of **community resource centers**. This ecosystem is supported by policy linkages and impact assessment tools. Significant **income enhancement** was observed: **114%** in livestock-based activities, **96%** in poultry, and **67%** in fisheries. Impact highlights include gross monthly incomes of ₹25,000 from poultry, ₹15,000 from goat rearing units, and ₹50,000 from value-added fish products by SHGs. These outcomes underscore the model's capacity to transform rural women from passive beneficiaries into self-reliant entrepreneurs. This offers a **gender-inclusive pathway** to enhance rural livelihoods and dismantle deep-rooted socio-cultural barriers. The findings have strong implications for **scaling this ideal across tribal and marginal farming communities**, contributing meaningfully to gender equity, rural entrepreneurship, and sustainable development.

Keywords: *Agripreneurship; Rural women; Capacity building; Institutions; Livelihood enhancement*

Genetic Evaluation of Edible-Podded Pea Genotypes for Climate-Resilient Crop Improvement and Food Security**Saurabh Yadav, Rajinder Kumar Dhall***Department of Vegetable Science, Punjab Agricultural University, Ludhiana, India.***ABSTRACT**

Enhancing the genetic base of food crops is a key strategy to ensure agricultural sustainability and food security under changing climatic conditions. This study assessed the genetic diversity of 28 edible-podded pea genotypes, including sugar snap peas (*Pisum sativum* L. var. *macrocarpon*) and snow peas (*Pisum sativum* L. var. *saccharatum*), by evaluating phenological, vigor, yield-related, and biochemical traits across two distinct agro-climatic zones in India. Significant genetic variation was observed in most traits—particularly in vigor, yield, and biochemical parameters—accompanied by high genotypic and phenotypic coefficients of variation, heritability, and genetic advance. Phenological traits, except for the node of first flowering, exhibited limited variability, indicating a high level of adaptation across environments. Correlation analysis revealed that yield per plant was positively associated with pod length, number of seeds per pod, number of pods per plant, and pod weight, highlighting these traits as key selection criteria in breeding programs. Principal component analysis (PCA) identified six components that explained over 75% of the total variation, with yield and biochemical traits contributing most significantly. The results underscore the potential of selected genotypes for the development of climate-resilient, high-yielding pea cultivars, thereby supporting sustainable agricultural systems and improving nutritional security.

Keywords: *Correlation; Diversity; Edible podded peas; Heritability; Variability*

Revisiting Gandhian Principles in Contemporary Indian Foreign Policy: Toward a Sustainable and Ethical Global Order

Ankesh Shubham Pandey, Iswar Saran

PG. College (University of Allahabad), Prayagraj, India.

ABSTRACT

This study looks at how Gandhian values—such as truth (satya), self-reliance (swadeshi), non-violence (ahimsa), and moral diplomacy—are still relevant and applied today in forming India's foreign policy in the larger framework of ethical global governance and sustainable development. India's foreign policy faces numerous regional and international problems in a time of escalating geopolitical tensions, economic protectionism, and environmental crises. The intricate interplay of regional diplomacy and strategic interests is highlighted by India's relations with a number of its neighbours, including the recent diplomatic tensions with the Maldives over military presence, strategic balancing in Sri Lanka amid growing Chinese influence, and changing engagements with Nepal and Bhutan. A careful balance between realism and moral leadership is also needed in light of India's complex position in the on-going Israel-Gaza and Russia-Ukraine conflicts, the ambitious but diplomatically delicate India–Middle East–Europe Economic Corridor (IMEC), and tense trade relations with the United States, particularly over tariffs and technology transfer. India's strategic environment is further complicated by the on-going conflict and border tensions with Pakistan, as well as by Turkey's public criticism of Kashmir and growing diplomatic assertiveness in South Asia. Despite its contributions to international diplomacy and peacekeeping, India's bid for a permanent seat on the UN Security Council (UNSC) has encountered opposition, highlighting the necessity of a morally sound and widely regarded foreign policy. Gandhian philosophy provides an alternative strategic vision based on truth-based diplomacy, inclusive development, mutual respect, and non-violence in the face of these difficulties. This study makes the case that India may effectively handle these foreign policy issues by encouraging peaceful coexistence, regional cooperation, and long-term relationships through the prism of Gandhian ideals. This strategy is already somewhat reflected in initiatives like the International Solar Alliance, Yoga and India's leadership in South-South cooperation. The study critically assesses how applying Gandhian ideas to modern diplomacy can assist India in enhancing its soft power and coordinating its international position with the Sustainable Development Goals (SDGs) of the UN. In the end, it argues that a Gandhian paradigm—far from being idealistic—offers a practical yet moral basis for negotiating the global challenges of the twenty-first century and assisting in the creation of a more just, peaceful, and sustainable international order.

Genetic Variability and Genome-Wide Association Study for Early Blight Resistance in Tomato (*Solanum lycopersicum* L.)

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ABSTRACT

Early blight, caused by *Alternaria solani*, significantly impacts global tomato production, causing yield losses of up to 80% under favorable conditions. This study investigates the genetic variability and identifies quantitative trait loci (QTLs) linked to early blight resistance in a 260-accession tomato association mapping panel (TAMP) through genome-wide association studies (GWAS). Field trials conducted in Bengaluru and Devihosur revealed substantial phenotypic variation. Genotyping was

performed using 119 highly polymorphic Simple Sequence Repeat (SSR) markers, strategically covering the entire tomato genome. Population structure analysis partitioned the accessions into seven distinct subpopulations among the accessions, indicating significant genetic diversity influenced by geographical origins. GWAS identified 21 significant ($p < 0.05$) marker-trait associations (MTAs) for disease resistance traits with key markers such as LEat18 (chromosome 3), LEaat1 (chromosome 9) and BF-CHO3 (chromosome 7) with highest phenotypic variance (R^2) of 4.715 explained by significant marker LEaat1 through marker-trait association analysis. The integration of phenotypic data with genotypic profiles through advanced statistical models not only elucidates the complex genetic architecture of early blight resistance but also provides robust molecular markers for marker-assisted selection (MAS). The identified resistance loci offer valuable genetic resources for breeding programs aimed at developing resilient tomato cultivars capable of withstanding early blight pressure, thereby ensuring sustainable tomato production.

Keywords: *Tomato; Early Blight; GWAS; Genetic Variability; Marker-Assisted Selection; QTL Mapping*

Study the Vegetative Growth of Fodder Legumes Intercropped with Fodder Maize

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ABSTRACT

A field experiment was conducted during the Kharif season of 2022-23 at Agronomy Farm, School of Agricultural Sciences, Nagaland University with objectives to study the effect of row proportion of fodder maize on growth and yield of fodder legumes. The present investigation encompassing fodder maize with fodder cowpea and fodder rice bean intercropped with different row ratio. The treatments included C₁ - Sole maize, C₂ - Sole Cowpea, C₃ - Sole Rice bean, C₄ - Maize + Cowpea (1:1), C₅ - Maize + Rice bean (1:1), C₆ - Maize + Cowpea (2:1), C₇ - Maize + Cowpea (2:1), C₈ - Maize + Cowpea (2:2) and C₉ - Maize + Rice bean (2:2). Plant height (312.51 cm, 225.13 cm), number of leaves plant⁻¹ (95.77, 68.23), stem girth (3.17 cm, 2.80 cm), primary branches plant⁻¹ (5.67, 4.20), leaf stem ratio (0.78, 0.44), fresh weight (454.30 g, 248.29 g) and dry weight (106.98 g, 34.55 g) of fodder cowpea and fodder rice bean was observed from sole plot C₂ and C₃. Among the row ratio higher vegetative growth i.e. plant height, number of leaves plant⁻¹, stem girth, primary branches⁻¹ of fodder legumes was observed at 1:1 ratio followed by 2:2 ratio. The highest pooled leaf length (13.36 cm), leaf width (9.10 cm) and leaf area (123.20 cm) for fodder cowpea was observed in C₆ and followed by C₄ and C₂. For fodder rice bean C₉ (12.03 cm) recorded the highest leaf length, while C₇ maintained the highest leaf width (7.59 cm) and leaf area (90.41 cm). Similarly, green fodder yield (34.39 t ha⁻¹, 34.22 t ha⁻¹) and dry fodder yield (5.65 t ha⁻¹, 5.16 t ha⁻¹) of fodder cowpea and fodder rice bean was also obtained from sole plot C₂ and C₃. Under different row ratio, higher green fodder yield and dry fodder yield was observed at 2:2 ratio followed by 1:1 row ratio and while the lowest yield production was recorded at 2:1 row ratio.

Keywords: *intercropping system; vegetative growth parameters; green and dry fodder yield*

Effect of organic, chemical source and Azotobacter culture on growth of cauliflower and soil fertility**Ashok Kumar Singh, Hazid Ansari, Mandhata Singh and Munendra Pal***Department of Soil Science and Agricultural Chemistry**Department of Soil Conservation, Shri Murli Manohar Town P.G. College Ballia (Jananayak Chandrashekhar University Ballia U.P), India.***ABSTRACT**

A pot experiment was conducted on growth yield of cauliflower and soil fertility of alluvial soil in 2024 under the influence of organic, chemical and Azotobacter as sources of nutrients in sandy loam soil. Experiment was comprised in 10 treatment (T₁ - 100% R.D.F (Urea + SSP + MOP) +S+ Zn, T₂ – FYM @ 40 t/ha + culture Azotobacter, T₃ - FYM @ 60 t/ha, T₄ - Vermicompost @ 40 t/ha + Azotobacter, T₅ - Vermicompost @ 60 t/ha, T₆ - Poultry Manure@ 20 t/ha + Azotobacter, T₇ - Poultry Manure @ 40 t/ha, T₈ - Dry Leaf @ 40 t/ha + Azotobacter, T₉ - Dry Leaf @ 60 t/ha +25% RDF (Urea + SSP+ MOP), T₁₀ - Compost @ 20 t/h + Flyash 10 t/ha), 3 replication under RBD with cauliflower crop, variety - Girija Hybrid. The organic, chemicals and Azotobacter combination were resulted as soil pH and EC showed decreased treated with compost and different treatment with different pots with little variation. CaCO₃ content in soil also decreased by the application of T₇- poultry manure@ 40 t/ha. Organic carbon content was resulted significantly higher in soil sample in treatment -T₇ where poultry manure + Azotobacter was added than other treatments of organic manure. The available nitrogen content in soil showed that T₇ (Poultry Manure 40t/ha) increased the maximum value 398.27(kg/ha) in and T₈ (Dry Leaf 60 t/ha + Azotobacter), was showed Heat very small amount 285.42 kg/ha in soil. The treatment combination of organic + Azotobacter culture was showed small variation in amount of available phosphorus but considerable maximum value increase in content of available potassium in than other treatment. The T₇ (Poultry Manure 40t/ha) maximum was showed increased in available sulphur content of 18.35 mg/kg white the lowest was in T₁ (100% RDF). The maximum fresh weight of plant 310.8 g was observed in the application of T₇ (poultry manure 40t/ha) and the minimum fresh weight of plant (230.50g) was observed in the application of the T₈ (Dry Leaf 40 t/ha + Azotobacter). The maximum. dry weight of curd 147.2g was observed in the application of T₇ (Poultry Manure @ 40 t/ha) and the minimum dry weight of curd 86.53g was observed in the application of the T₈ (Dry Leaf 40 t/ha + Azotobacter) the weight of all dry curds was recorded in increasing range. The maximum fresh weight of plant 310.8 g was observed in the application of T₇ (poultry manure 40t/ha) and the minimum fresh weight of plant (230.50g) was observed in the application of the T₈ (Dry Leaf 40 t/ha + Azotobacter).

Keywords: *sources of nutrients; soil available nutrients; dry curd yield; fresh curd yield; plant dry weight*

Nematicidal Potential of Walnut (*Juglans regia*) Green Husk to mitigate Root-Knot Nematode infestations in cucurbit crops**Sonia waqar, Abrar Ahmad Khan***Section of Environmental Botany and Plant Pathology, Department of Botany, Aligarh Muslim University, Aligarh, India.***ABSTRACT**

The increasing environmental and health concerns associated with chemical pesticides and nematicides have driven the quest for eco-friendly and sustainable practices, which has led to the exploration of organic nematicides as an alternative plant protection method. The current study sought to determine the potential of Walnut green husk (WGH) as a botanical nematicide against *Meloidogyne incognita* infestations in cucurbitaceous crops (bottle gourd and cucumber) at different concentrations: 0.5%,

1.0%, 1.5%, 2.0%, and 2.5%. Field trials revealed a significant reduction in disease indices like egg masses and galls per root system. *Meloidogyne incognita* inoculation significantly reduced the growth, yield, and biochemical and physiochemical attributes of both plants compared to untreated uninoculated plants. Plants grown at a 2.0% WGH level showed significantly improved plant performance, yield, and photosynthetic pigment compared to the untreated inoculated plants. Additionally, the 2.0% WGH application strengthened the antioxidant defense system in plants by regulating ROS accumulation and enhancing antioxidant defense enzymes SOD (superoxide dismutase) and CAT (catalase) to combat nematode-induced biotic stress. Our results highlighted that a 2.0% WGH exhibits strong nematicidal efficacy and thus offers a sustainable, eco-friendly approach for nematode management that minimizes chemical dependency while improving plant growth and yield. Furthermore, *in vitro* studies demonstrated strong, dose-dependent inhibition of egg-hatching and juvenile mortality, highlighting the nematicidal properties of WGH.

Keywords: *Nematicide; Walnut green husk; M. incognita; Sustainable management; Cucumber; Bottle gourd*

Revisiting Gandhian Principles in Contemporary Indian Foreign Policy: Toward a Sustainable and Ethical Global Order

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ABSTRACT

This study looks at how Gandhian values—such as truth (satya), self-reliance (swadeshi), non-violence (ahimsa), and moral diplomacy—are still relevant and applied today in forming India's foreign policy in the larger framework of ethical global governance and sustainable development. India's foreign policy faces numerous regional and international problems in a time of escalating geopolitical tensions, economic protectionism, and environmental crises. The intricate interplay of regional diplomacy and strategic interests is highlighted by India's relations with a number of its neighbours, including the recent diplomatic tensions with the Maldives over military presence, strategic balancing in Sri Lanka amid growing Chinese influence, and changing engagements with Nepal and Bhutan. A careful balance between realism and moral leadership is also needed in light of India's complex position in the on-going Israel-Gaza and Russia-Ukraine conflicts, the ambitious but diplomatically delicate India–Middle East–Europe Economic Corridor (IMEC), and tense trade relations with the United States, particularly over tariffs and technology transfer. India's strategic environment is further complicated by the on-going conflict and border tensions with Pakistan, as well as by Turkey's public criticism of Kashmir and growing diplomatic assertiveness in South Asia. Despite its contributions to international diplomacy and peacekeeping, India's bid for a permanent seat on the UN Security Council (UNSC) has encountered opposition, highlighting the necessity of a morally sound and widely regarded foreign policy. Gandhian philosophy provides an alternative strategic vision based on truth-based diplomacy, inclusive development, mutual respect, and non-violence in the face of these difficulties. This study makes the case that India may effectively handle these foreign policy issues by encouraging peaceful coexistence, regional cooperation, and long-term relationships through the prism of Gandhian ideals. This strategy is already somewhat reflected in initiatives like the International Solar Alliance, Yoga and India's leadership in South-South cooperation. The study critically assesses how applying Gandhian ideas to modern diplomacy can assist India in enhancing its soft power and coordinating its international position with the Sustainable Development Goals (SDGs) of the UN. In the end, it argues that a Gandhian paradigm—far from being idealistic—offers a practical yet moral basis for negotiating the global challenges of the twenty-first century and assisting in the creation of a more just, peaceful, and sustainable international order.

Pheromone Trap Based Eco-Friendly Management of Pink Bollworm in Bt Cotton**Shakti Khajuria, Renu Godara and Kanak Lata***ICAR-CIAH-KVK, Panchmahal, Gujarat, India.***EXTENDED SUMMARY****Purpose**

Pink bollworm (*Pectinophora gossypiella*) has become a major threat to Bt cotton cultivation, causing extensive damage to cotton bolls and significantly reducing crop yield. This pest infestation results in considerable economic losses for farmers and poses a serious challenge to sustainable cotton production. To address this issue, a frontline demonstration was carried out to evaluate the effectiveness of pheromone traps as an eco-friendly, non-chemical approach within an Integrated Pest Management framework. The main objective was to reduce the incidence of pink bollworm, enhance crop productivity, increase farmers' income, and promote sustainable pest control practices in Panchmahal district of Gujarat.

Material and Methods

The demonstration was implemented during the 2021-22 cotton season on 12 farmers' fields, covering a total of 4 hectares of Bt cotton. The intervention included the installation of 40 pheromone traps per hectare, positioned 30 cm above the crop canopy, spaced uniformly to ensure effective monitoring and trapping of pink bollworm males. The traps were installed one week before flowering—the critical stage for pest attack and monitored regularly. Lures were replaced monthly to maintain trap efficiency throughout the crop season, right up to the final picking. A local check plot representing farmers' traditional practices (without pheromone traps) was maintained for comparison.

Data collection focused on the extent of boll damage, crop yield, and economic parameters such as gross income, net income, and the Benefit-Cost Ratio.

Results

The frontline demonstration effectively showcased the potential of pheromone traps in managing pink bollworm infestation in Bt cotton. Fields with pheromone trap installation recorded significantly reduced boll damage at 4.0%, compared to 6.5% in the local check. This notable reduction in pest incidence led to an improvement in productivity. Demonstration plots yielded an average of 21.5 quintals per hectare, while the local check produced only 18.0 quintals per hectare, reflecting a 19.44% increase in yield.

Economic evaluation also highlighted the benefits of the technology. The gross income from demonstration plots was ₹1,07,500 per hectare, compared to ₹90,000 per hectare in the check plots. Net income was ₹66,500 per hectare in the demonstration fields, as opposed to ₹51,800 per hectare in the local check. The Benefit-Cost Ratio also improved from 2.36 in the check to 2.62 in the demonstration. Participating farmers expressed high satisfaction with the technology, noting reduced pesticide use, healthier crop stands, and higher returns, making pheromone traps a promising eco-friendly pest management tool.

Conclusions

The use of pheromone traps for managing pink bollworm in Bt cotton proved to be a cost-effective, environmentally sustainable, and farmer-friendly approach. The results from the FLD affirm that this method significantly reduces pest infestation, increases yield, and enhances economic returns. Given its simplicity and effectiveness, this technique is highly recommended for wider dissemination among cotton-growing farmers as part of a comprehensive Integrated Pest Management strategy.

Keywords: *Bt Cotton; Pink Bollworm; Pheromone Traps; Integrated Pest Management*

Use of rice landraces and rhizobium inoculated seed cope to salinity stress in seedling stage
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ABSTRACT

The two experiments were conducted to evaluate the rhizobium inoculation rice seed and landraces of rice on germination parameter and physiological parameter under salt stress. The main objective of study was to find out effect of rhizobium inoculation on rice seedlings on different salinity conditions. Experiment was laid out in five different genotypes (Ghaiya 3, Hardinath3, DRR Dhan 44, Hardinath4, IR 1851001) and 4

different salt concentration (control salt concentration, 1.25 ppm, 2.5 ppm, 5 ppm) and 3 replication under 2 factor factorial CRD. The genotype IR 1851001 showed higher germination percentage (86.50), lowest mean germination time (5.258), higher germination rate (16.72), higher germination energy (0.8650), higher germination index (8.891) than other genotypes. The highest germination percentage (86.73) and highest germination rate (16.75) was found in control salt concentration (0 ppm). The mean germination time was found statically at par with in all salt concentration. The higher root length and root to shoot length was found in DRR Dhan followed by Ghaiya 3. The higher shoot length and seed vigor index was found in Hardinath 3, and IR 1851001 respectively. The root length, shoot length, root to shoot length ratio, seed vigor index was found non significant and the data are statically at par in all salt concentration. The result was found non-significant for fresh weight, dry matter, and dry matter accumulation among different genotypes and salt concentration in rhizobium inoculated seeds. However, more research is required, taking a range of rhizobium inoculation techniques, other rice genotypes, and environmental conditions into consideration.

Robotics in Agriculture for Sustainability

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ABSTRACT

The integration of robotics in agriculture has emerged as a transformative approach to addressing the challenges of increasing productivity and sustainability. As global populations rise and arable land decreases, the adoption of robotic technologies offers solutions to optimize agricultural practices, reduce labor dependency, and minimize environmental impact. This paper explores the multifaceted role of robotics in modern agriculture, highlighting the benefits, challenges, and future trends of robotic systems. Key applications include precision farming, automated harvesting, and smart irrigation, all of which contribute to a more efficient and sustainable agricultural sector. Despite the promising potential, there are significant hurdles to overcome, including high costs, technological limitations, and the need for tailored solutions across diverse agro-ecological environments

The deployment of robotics in agriculture presents a significant opportunity to enhance productivity and sustainability in the sector. By automating key processes such as planting, monitoring, and harvesting, robotics can reduce the reliance on human labor and improve resource efficiency. The environmental benefits, including reduced chemical usage and more precise irrigation, align with the broader goals of sustainable development. However, realizing the full potential of agricultural robotics requires addressing challenges related to cost, technological advancement, and adaptability to diverse agricultural conditions. As the technology continues to evolve, it is crucial for stakeholders—including scientists, engineers, policymakers, and farmers—to collaborate closely to overcome these barriers. Future advancements in integrated robotic systems will likely play a pivotal role in shaping the next generation of agricultural practices, ensuring that they are more efficient, sustainable, and capable of meeting the global food demand.

Keywords: *Robotics; Environment; Modern Agriculture; Resource efficiency; Sustainability*

Heterosis for seed cotton yield and fibre quality traits in american Bt (BG II) cotton hybrids under rainfed condition

V.N.Chinchane, K.S.Baig ·A.R.,S.N.Devkule, U.V.Surewad and G.P.Idhole

Cotton Research Station, Nanded, India.

ABSTRACT

Cotton is the most important fibre crop grown in India. Cotton is used in textile industries while it is also called as king of fiber, white gold crop. Since India is having a large domestic textile industry, the mill consumption of cotton in the country especially, textile mills and small scale spinning unit had been continuously on the rise. In the present investigation, twenty american Bt cotton hybrids developed through a Line x Tester mating design involving 5 different female lines and 4 male lines using deregulated Cry 1 Ac and Cry 2 Ab event at Cotton Research Station, Nanded along with two standard checks viz., Suraj Bt and NHH 44 BG II were evaluated at Cotton Research Station, Nanded during Kharif 2023-24. These genotypes were analysed for fibre quality parameters like Upper Half Mean Length, micronaire, fibre strength, ginning outturn, as well as for quantitative characters like seed cotton yield and yield contributing traits viz., number of sympodia per plant, number of bolls per plant, plant height, boll weight etc.

Analysis of variance carried out for fourteen characters showed significant treatment differences for all characters studied. It indicated presence of substantial genetic variability among the selected parental lines. The magnitude of heterosis, standard heterosis for all the characters in the present study was highly appreciable. Among all the characters, the highest magnitude of better parent (88.24) and standard heterosis (90.10) were highest in the cross NH 22275 Bt x NH 22293 Bt for seed cotton yield per plant. Out of twenty crosses, the crosses showed highest and desirable significant standard heterosis for various traits viz., cross NH 22397 Bt x NH 22293 Bt for days to 50 per cent flowering, NH 22275 Bt x NH 22293 Bt for number of sympodia per plant, NH 22259 Bt x NH 22362 Bt for boll weight, NH 22426 Bt x NH 22498 Bt for lint index, NH 22259 Bt x NH 22362 Bt for upper half mean length, NH 22426 Bt x NH 22498 Bt for fiber fineness, NH 22397 Bt x NH 22293Bt for fibre strength and NH 22259 Bt x NH 22293 Bt for uniformity ratio these were found most superior cross combinations for respective characters.

Keywords: *Bt cotton; seed cotton yield; fibre quality traits; Cry 2 Ab*

Evaluation of American Bt (BG II) cotton for sucking pest tolerance under rainfed condition

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Cotton Research Station, Nanded, India.

ABSTRACT

Cotton plays an important role to the Indian economy. It provides basic raw material for the cotton textile industry. The oldest cotton textiles were discovered in the graves and city ruins of cultures from all climates where textiles did not completely degrade. It is one of the most important fibre crop. It has a large potential to generate employment in both rural and urban areas. Cotton in India is a direct source of income for 6 million farmers, while the cotton trade and processing employs approximately 40-50 million people.

In the present investigation, twenty american Bt cotton hybrids developed through a Line x Tester mating design involving 5 different female lines and 4 male lines using deregulated Cry 1 Ac and Cry 2 Ab event at Cotton Research Station, Nanded along with two standard checks viz., Suraj Bt and NHH 44 BG II were evaluated at Cotton Research Station, Nanded during Kharif 2023-24. These genotypes

and hybrids were analysed for assessing the performance of genotypes and there resultant crosses for sucking pest tolerance traits such as number of aphids. Jassids, thrips and white flies per 3 leaves, trichome density and leaf thickness.

Mean performance of number of aphids/3leaves ranged from NH 22275 Bt (3.2) to NHH 44 BG II (4.03). Among lines, NH 22275 Bt (1.61) found less infestation of jassids whereas, NH 22259 Bt (2.21). observed maximum infestation. Among testers range of number of jassids/3leaves was NH 22294 Bt (1.93) to NH 22362 Bt (2.15). Mean performance of number of thrips / 3 leaves ranged from 2.31 to 3.43. The cross NH 22426 Bt x NH 22498 Bt (1.51) recorded minimum number of white fly infestation, while NH 22275 Bt x NH 22293 Bt (2.56) recorded maximum number of whitefly /3leaves. The mean density of trichomes on adaxial surface among lines was ranged from 15.50 to 40.00. Line NH 22275 Bt (40.00) recorded maximum number of trichomes. Testers exhibited trichome density range from (18.00) NH 22362 Bt to (33.50) NH 22294 Bt. Crosses observed trichome density on abaxial surface within a range of 19.00 to 50.00. Cross combination NH 22259 Bt x NH 22293 Bt (19.00) observed minimum number of trichomes while crosses NH 22426 Bt x NH 22362 Bt (50.00) recorded maximum number of trichomes. Among lines, leaf thickness ranged from 0.38 mm to 0.60 mm. Line NH 22259 Bt exhibited maximum leaf thickness (0.60 mm) while line NH 22275 Bt observed minimum leaf thickness (0.38 mm). Among tester leaf thickness ranged from (0.49 mm) NH 22362 Bt to (0.54 mm) NH 22294 Bt. Crosses ranges from 0.36 mm to 0.63 mm for given trait. Cross NH 22426 Bt x NH 22362 Bt (0.36mm) measured least thickness. Whereas, the cross NH 22426 Bt x NH 22498 Bt (0.59 mm) measured maximum leaf thickness.

Keywords: *Bt cotton; sucking pest; trichome density; leaf thickness; jassids*

Climate-Resilient Hi-Tech Horticulture: Innovations in Crop Management, Food Processing and Value Addition under Changing Climatic Scenarios

Ronak Kuri, Naresh Kumar, Santosh Choudhary and Mahesh Kumar Poonia

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ABSTRACT

Climate change poses significant challenges to global horticultural production, threatening crop productivity, quality and sustainability. Rising temperatures, erratic rainfall patterns and increased incidences of pests and diseases necessitate a paradigm shift toward climate-resilient agricultural practices. Hi-tech horticulture encompassing precision farming, protected cultivation, sensor-based irrigation and climate-smart nutrient management offers viable solutions to mitigate these impacts. Additionally, advanced food processing technologies and value addition not only reduce post-harvest losses but also enhance the economic value and marketability of horticultural produce. This abstract highlights the role of climate-smart technologies in horticulture, assesses the effectiveness of protected cultivation under climatic stress, and explores innovative methods of processing and value addition to ensure food and nutritional security. Furthermore, it underscores strategies for integrating these approaches into holistic and sustainable production systems, with an emphasis on policy support, capacity building and digital innovation.

Keywords: *Climate change; Hi-tech horticulture; Precision farming; Protected cultivation; Food processing; Value addition; Resilience; Smart agriculture*

Influence of Humic Acid and Zinc Sulphate on Yield, and Yield Attributing parameters of Sesame (*Sesamum indicum* L.)**Abhijit Pal, Akankhya Pradhan And Rajesh Singh***Department of Agronomy, Naini Agricultural institute, SHUATS, Prayagraj, Uttar Pradesh, India.***EXTENDED SUMMARY****Abstract**

A field experiment was conducted during the kharif season of 2024 at the Crop Research Farm, Department of Agronomy, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (Uttar Pradesh), to evaluate the “Effect of Zinc Sulphate and Humic Acid foliar spray on the growth, yield of sesame”. The soil of experiment plot was sandy loam in texture, nearly neutral in soil reaction (pH 7.6), low in organic carbon (0.47%) available nitrogen (228 kg/ha), available phosphorus (22.9 kg/ha) and available potassium (236.1 kg/ha) The treatments consisted of 3 levels of Zinc Sulphate (15kg/ha, 20kg/ha and 25kg/ha) and Humic Acid (0.1 ml/l, 0.3 ml/l and 0.5 ml/l). The results revealed that the application of 20 Kg/ha Zinc Sulphate along with 0.3 ml/l Humic Acid foliar spray at 25 and 40 DAS (Treatment 6) significantly enhanced the growth and yield parameters. The highest seed yield (2.47 t/ha), maximum test weight (2.90 g), and highest harvest index (63.52 %) were obtained in Treatment 6, making it the most profitable treatment. Thus, the application of 20 Kg/ha Zinc Sulphate with 0.3 ml/l Humic Acid foliar spray at 25 and 40 DAS proved to be the best combination for achieving higher yield and economic returns in sesame cultivation.

Keywords: *Sesame; Yield; Yield attributes; Zinc sulphate; Humic acid*

Introduction

Sesame (*Sesamum indicum* L.), revered as the "queen of oilseeds," is a vital ancient crop cultivated globally. It is a nutritious food, rich in fiber, Sesame seeds contain 45-50% oil, 20% protein, and 14.2% carbohydrates, and are used in various products like paints, soaps, cosmetics, perfumes, and insecticides (Langham et al., 2006). Its high antioxidants, such as sesamin, sesamol, and sesamol, prolong its shelf life by preventing rancidity.

India leads in global sesame production, with 8.66 lakh tonnes from 19.47 lakh ha, accounting for one-third of the world's production. However, India's average yield (413 Kg/ha) is lower than the global average (535 Kg/ha). Improved varieties and agro-production technologies have been developed to enhance sesame yield through high-yielding varieties, proper nutrient management, and plant growth regulators, which improve photosynthesis, reduce respiration, and stimulate nitrogen metabolism.

To ensure the overall sustainability of production, combining organic and inorganic sources of nitrogen was deemed essential. Integrating these with humic substances, known to promote plant growth and yield in various crops, would be a viable proposition for achieving sustainability. Humic acid spray has significantly improved yield attributes, grain yield, oil, and protein content of sesame. Zinc being one of the essential micronutrients, plays significant role in various enzymatic and physiological activities of plant body. Zinc also plays a crucial role in metabolic processes of plants, such as protein synthesis and membrane integrity (Cakmak and Marschner, 1998).

Therefore, the present investigation was carried out to identify an integrated nitrogen management source for sesame and to assess the effects of Humic acid and ZnSO₄ on the performance and productivity of the crop.

Material and Methods

The experiment was conducted during the Kharif season of 2024 at the Crop Research Farm, Department of Agronomy, Naini Agriculture Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh. The soil been collected from the experimental site was tasted in laboratory and the results are been observed as Organic carbon (0.59%), Available Nitrogen (278.93 kg/ha), Available Phosphorus (37.80 kg/ha), Available Potassium (7.6), EC (0.542

(ds/m) The variety used was VIBHITI-999. The plants are grown at the spacing of 45cm X15 cm . The experiment was laid out in a Randomized Block Design (RBD) with 10 treatments and 3 replications, consisting of three levels of Zinc Sulphate (15, 20, and 25 Kg/ha) and three levels of Humic Acid foliar spray (0.1 ml/l, 0.3 ml/l, and 0.5 ml/l) applied at two growth stages (25 and 40 DAS). The combination of Zinc sulphate and humic acid are applied in following combinations, (T1) Zinc Sulphate () - 15 kg/ha + Humic acid - 0.1 ml/l, (T2) Zinc Sulphate () - 15 kg/ha + Humic acid - 0.3 ml/l, (T3) Zinc Sulphate () - 15 kg/ha + Humic acid - 0.5 ml/l, (T4) Zinc Sulphate () - 20 kg/ha + Humic acid - 0.1 ml/l, (T5) Zinc Sulphate () - 20 kg/ha + Humic acid - 0.3 ml/l, (T6) Zinc Sulphate () - 20 kg/ha + Humic acid - 0.5 ml/l, (T7) Zinc Sulphate () - 25 kg/ha + Humic acid - 0.1 ml/l (T8) Zinc Sulphate () - 25 kg/ha + Humic acid - 0.3 ml/l, (T9) Zinc Sulphate () - 25 kg/ha + Humic acid - 0.5 ml/l, and (T10) N-P-K, 40-40-60kg/ha (control). The yield attributes of sesame were analyzed by harvesting each plot from different treatments. After harvesting, the samples were air-dried and weighed to determine the yield per plot. These observations helped in analyzing the yield potential and productivity of the crop.

Result And Discussion

Yield Attributes

The results showed a significant effect of different treatments on the yield attributes of sesame. The number of branches per plant was highest (4.20) with the application of Zinc Sulphate 20 kg/ha with Humic Acid 0.5 ml/l, which was significantly superior over other treatments. The increase in branches was due to the improved metabolic and meristematic activities caused by increased nutrient availability (Ahmad et al., 2018).

The number of capsules per branch was significantly higher (24.13) with application of Zinc Sulphate 20 kg/ha + Humic Acid 0.5 ml/l. The improved capsule formation was attributed to better nutrient uptake and photosynthetic efficiency (Ahmad et al., 2018).

The maximum number of seeds per capsule (56.50) was observed with application of Zinc Sulphate 20 kg/ha and Humic Acid 0.5 ml/l. The increase in seed number was due to less intra-plant competition and better nutrient availability (Kathiresan et al., 2002).

The highest test weight (2.90 g) was obtained in Treatment 6, followed by Treatment 3 (2.86 g), which were statistically at par. The increased test weight could be attributed to enhanced nutrient absorption and better seed development due to the application of plant growth regulators (Caliskan et al., 2003).

Yield and Harvest Index

The seed yield of sesame showed a significant difference among the treatments. The highest seed yield (2.47 t/ha) was recorded with application of Zinc Sulphate 20 kg/ha and Humic Acid 0.5 ml/. The higher yield was attributed to better nutrient availability, enhanced photosynthesis, and improved dry matter translocation to seeds (Braz et al., 1998).

The stover yield showed no significant differences among the treatments. However, the highest stover yield (2.18 t/ha) was recorded in the Control , while the lowest stover yield (1.43 t/ha) was observed in Treatment 6 due to higher seed formation and reduced vegetative growth.

The highest harvest index (63.52%) was recorded in Treatment 6, indicating better resource utilization and dry matter partitioning towards seed production, while the lowest harvest index (44.97%) was observed in the Control.

The relationship between soil organic carbon and nitrogen budgets and climate change in a soybean plantation under long-term phosphorus dose applications**Furkan Kemal ÖTE, Mehmet ELALDI, Burak Mert ÇETİN, İbrahim ORTAŞ***Department of Soil Science and Plant Nutrition, Faculty of Agriculture, Çukurova University, Adana-Türkiye.***ABSTRACT**

The purpose of this study is to evaluate the effects of long-term phosphorus (P) fertilization on the soil organic carbon, nitrogen, and phosphorus budget under soybean cultivation. Soybean is a globally significant protein source and play a crucial role in food security and climate resilience. Furthermore, the study aims to contribute to sustainable phosphorus fertilizer management by investigating the impacts of phosphorus applications on soil carbon and nitrogen content and mycorrhizal activity.

The research was conducted as a long-term field experiment at Çukurova University, Adana-Turkey. The 'Arisoy' soybean cultivar was used, and phosphorus was applied at rates of 0, 50, 100, and 200 kg P₂O₅ ha⁻¹, using Triple Super Phosphate (TSP) as the fertilizer source. Soil samples were collected from two depths: 0–15 cm and 15–30 cm, and subjected to physical, chemical, and biological analyses. Mycorrhizal spore numbers were evaluated in both rhizosphere and non-rhizosphere soil zones.

Increasing phosphorus doses significantly enhanced soil bulk density and phosphorus (P₂O₅) content, particularly in the rhizosphere soils. The highest values were observed in the P200 treatment. Although organic carbon and total nitrogen levels showed an upward trend, not all differences were statistically significant. SOC concentration increased from 1.38% to 181% with dose increases in the rhizosphere 0-15 cm soil depth. SOC content increased in the same trend as well. No significant changes were detected in stable soil properties such as lime (CaCO₃) and inorganic carbon (IC). High phosphorus doses (P100 and P200) contributed to improved nutrient accumulation, carbon sequestration, and plant yield. However, excessive phosphorus suppressed mycorrhizal symbiosis. Mycorrhizal spore counts declined with increasing phosphorus levels, especially in the 0–15 cm rhizosphere layer ($r = -0.92$). This finding underscores the importance of balancing productivity with soil biological health and highlights the need for balanced phosphorus management in sustainable agriculture. Research findings indicate that soil organic carbon content increases with increasing phosphorus dose application, providing important information about the carbon sources that contribute to CO₂, a greenhouse gas released from soil into the atmosphere that causes climate change.

Keywords: *Soya bean; phosphorus; nitrogen and soil organic carbon content***Note:** This work was supported by PRIMA SHARInG-MeD -2211**Assessing the Impact of Climate-Induced Heat Stress on Respiratory Health in Vulnerable Urban Populations: A Cross-Sectional Study in Eastern India****Prateek Singh, Sudipta Das***Department of Hospital Management, NSHM Knowledge Campus, Durgapur, West Bengal, India.***ABSTRACT**

The intensification of climate change has escalated the frequency and severity of heatwaves across South Asia, resulting in significant public health challenges. This study investigates the correlation between prolonged heat exposure and the prevalence of respiratory health issues in vulnerable urban populations, particularly among slum dwellers and high-density settlements in Durgapur, India. A cross-sectional survey involving 350 respondents was conducted using a structured questionnaire covering self-reported respiratory symptoms, environmental exposure, and healthcare-seeking behavior. Results indicated a 62% increase in respiratory symptoms—such as breathlessness, dry cough, and wheezing—during heatwave periods, disproportionately affecting children under 10 and elderly individuals above

60. Qualitative data from Focus Group Discussions (FGDs) revealed poor ventilation, increased indoor air pollution, and lack of awareness as key contributing factors. The study highlights a critical need for climate-resilient health infrastructure, early heat stress warning systems, and community-based adaptation strategies to mitigate the growing burden of heat-related respiratory morbidity. Policy integration of climate and health is imperative to safeguard marginalized urban communities from evolving climate-health risks.

Keywords: *Climate change; heat stress; respiratory health; vulnerable populations; urban public health; SDG 3; environmental health*

Application of Hi-Tech Horticulture and Innovative Processing for Enhanced Value Addition in Carrot (*Daucus carota* L.)

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ABSTRACT

The ongoing changes in carrot (*Daucus carota* L.) production and post-harvest management are driven by high-tech horticulture and modern food processing. These improvements are setting new standards for adding value in the agri-food sector. This study presents a clear strategy that includes precision farming, protected cultivation, and molecular breeding to develop top carrot varieties. These varieties are known for their higher yields, consistency, and better phytonutrient profiles. By using modern tools like environment monitoring systems, automated fertigation, and marker-assisted selection for genetic traits, carrot crops are optimized for both farming results and nutritional quality. After harvest, innovative processing technologies, including non-thermal preservation methods, minimal processing, and recycling of by-products, help keep the vitamins, antioxidants, and other beneficial components in the final products. These methods lead to a wider range of value-added carrot products, such as functional beverages, snacks rich in nutraceuticals, dietary fibres, purees, and powders. This variety meets the growing market demand for healthy, convenient, and long-lasting options. Furthermore, transforming processing by-products into ingredients like dietary fibres or animal feed increases economic returns and supports environmental sustainability. The combination of precision farming and modern processing boosts nutritional security and food safety while improving efficiency and profitability along the supply chain. The findings show significant improvements in product quality, shelf life, and market access, benefiting both producers and consumers. This integrated model, driven by innovation, helps reposition carrots from a traditional root vegetable to a valuable, sustainable part of modern agri-food systems.

Keywords: *carrot; innovative processing; value addition; molecular breeding; precision agriculture; protected cultivation; nutraceuticals; nutritional security*

Table 1:- Effect of Zinc Sulphate () and Humic acid on yield and yield attributes of Sesame.

S No	Treatments	Number of branches per plant (no.)	Number of capsules per branch (no.)	Number of seeds per capsule (no.)	Test weight (gm)	Seed yield (t/ha)	Stover yield (t/ha)	Harvest index (%)
1.	Zinc Sulphate () - 15 kg/ha + Humic acid - 0.1 ml/l	3.80	23.15	54.90	2.82	2.02	2.02	50.11
2.	Zinc Sulphate () - 15 kg/ha + Humic acid - 0.3 ml/l	4.07	24.07	55.05	2.77	2.21	1.90	54.06
3.	Zinc Sulphate () - 15 kg/ha + Humic acid - 0.5 ml/l	3.93	23.50	56.10	2.86	2.21	1.49	60.25

4.	Zinc Sulphate () - 20 kg/ha + Humic acid - 0.1 ml/l	3.53	22.95	55.66	2.79	1.87	2.00	48.48
5.	Zinc Sulphate () - 20 kg/ha + Humic acid - 0.3 ml/l	3.67	23.30	55.60	2.84	2.00	1.75	53.91
6.	Zinc Sulphate () - 20 kg/ha + Humic acid - 0.5 ml/l	4.20	24.13	56.50	2.90	2.47	1.43	63.52
7.	Zinc Sulphate () - 25 kg/ha + Humic acid - 0.1 ml/l	4.07	22.65	54.75	2.76	2.06	1.79	53.57
8.	Zinc Sulphate () - 25 kg/ha + Humic acid - 0.3 ml/l	3.73	22.34	55.45	2.72	1.86	1.95	48.93
9.	Zinc Sulphate () - 25 kg/ha + Humic acid - 0.5 ml/l	3.93	23.86	56.13	2.52	1.98	1.87	51.83
10.	Control (N:P:K -40:40:60 kg /ha)	3.53	22.50	55.30	2.74	1.78	2.18	44.97
	F – Test	S	S	S	S	S	NS	NS
	SE m (±)	0.142	0.384	0.335	0.065	0.121	0.170	3.580
	CD (p=0.05)	1.422	1.141	1.003	0.195	0.365	---	---

Conclusion

From the above Study it can be concluded that application of Zinc Sulphate- 20 kg/ha with Humic acid - 0.5 ml/l in sesame crop recorded highest seed yield and benefit cost ratio in Kharif season.

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Microscopic study of pollen viability of barley landraces under different planting date**Neha Mahato, Sneha Tripathi, Ashim Adhikari, Srijana Aryal, Sampada Acharya, Sushma Yadav, Abhishek Shrestha***College of Natural Resource Management, Bardibas, Nepal.***ABSTRACT**

Pollen sterility induced by heat stress is a major physiological constraint affecting fertilization and yield in barley (*Hordeum vulgare* L.). A field experiment was conducted during the winter season of 2024 at the College of Natural Resource Management (CNRM), Bardibas, Nepal, to assess the impact of elevated temperature on pollen viability across thirty-two barley genotypes. The genotypes were sown at three different dates—10th December 2024, 25th December 2024, and 10th January 2025—under well-irrigated conditions using a strip plot design. Pollen viability was evaluated microscopically using 1% iodine-potassium iodide (I₂KI) staining, with scoring based on pollen morphology and staining intensity. Results showed that early sowing (10th December) resulted in high pollen fertility in over 86% of genotypes, while late sowing (10th January) led to a 71% reduction in viability. However, five genotypes—NGRC 7575, NGRC 5107, AFU202501, AFU202502, and C.V.T-H 107/1—maintained relatively high pollen fertility under heat stress. These findings highlight the sensitivity of barley reproductive development to temperature and identify promising heat-tolerant genotypes for future breeding programs.

Keywords: *Barley; pollen sterility; pollen viability; sowing dates; I₂KI staining*

Job Satisfaction Of Women Extension Personnel Of State Agriculture Department**Swati Gawande¹, Dr. S. P. Lambe¹, Dr. R.T. Katole¹, Dr.S.D. Sarnaik¹, Devyancee K. Nemade²**¹*Department of Extension Education, Dr. PDKV, Akola, India.*²*Agricultural Economics, College of Agriculture, Dr. PDKV, Akola, India.***ABSTRACT**

Women are the backbone of agriculture workforce, but worldwide her hard work has been mostly unpaid. On an average there are 43 percent of women agricultural force in the developing countries. Gender equality is a very necessary foundation for very gender equality is necessary foundation for a peaceful, prosperous and sustainable world. Agriculture Assistants are very important role, who play as a vital link between research and farm technology transfer for it's effective dissemination and ultimate implementation for the agriculture developmental initiatives

The present study entitled, 'job satisfaction of Women Extension Personnel of State Agricultural Department' was carried out in Akola and Washim districts under vidarbha region of Maharashtra state. The sample for the study was confined to the 80 women extension personnel working in the state agriculture department to ascertain the job performance and job satisfaction of the women extension personnel.

Job satisfaction was assumed to be correlated with each other. It was observed that, job performance of an individual increases with the increase in the job satisfaction. Keeping this inview the job satisfaction of the women extension personnel was studied. It was observed that, more than three fourth (87.50%) of the women extension personnel were recorded their satisfaction while working as the women extension personnel, while (12.50%) of the women extension personnel recorded their highest level of satisfaction while working.

Vermitechnology: A nature-based solution for sustainable remediation and recycling of coal mine waste into nutrient-rich organic amendments**Sumit Kumar^{1,2}, Pradip Bhattacharyya¹, Pankaj Kumar Roy³**¹*Agricultural and Ecological Research Unit, Indian Statistical Institute, Giridih, Jharkhand, India.*²*School of Environmental Studies, Jadavpur University, Kolkata, West Bengal, India.*³*School of Water Resource Engineering, Jadavpur University, Kolkata, West Bengal, India.***ABSTRACT**

The generation and improper disposal of coal mine waste (CMW) contribute to significant environment problems ranging from heavy metal (HMs) pollution, acid mine drainage, causing soil degradation and ecological imbalance. CMW, despite being rich in carbon and locked essential nutrients, their direct use is restricted due to its HM benignity. Vermicomposting the CMW waste is an ecofriendly solution to transform and remove HMs content. Certain earthworm species like *Eisenia fetida* have ability to transform available forms of HMs to non-bioavailable forms. *Eisenia fetida* during HM stress condition activates metallothionein gene producing metallothionein proteins in their gut, responsible for immobilizing HMs. Apart from the metal detoxification the microbes present in the earthworm gut helps in mineralizing locked essential nutrients (NPK) and improves abundance of useful microbial communities. This study was conducted to remediate and transform CMW into nutrient-rich agricultural amendment product. The CMW were supplemented with cow dung in different ratios (1:1 and 2:1). The result indicated significant reduction of HMs bioavailability in the end product (vermicompost prepared from CMW). The maximum efficiency in the setup was observed for the Cr (73.45%) followed by Cu (68.52%), Pb (60.03%), and Ni (47.19%). The essential nutrients were also found to be enhanced N (30%). The observations of this study highlight the effectiveness of *Eisenia fetida* in transforming the CMW by enhancing the physicochemical and microbial properties while reducing the HMs bioavailability. The study concluded that the CMW amended with cow dung in 1:1 ratio yielded the best result.

Keywords: *Eisenia fetida*; Vermicomposting; Circular economy; Sustainable waste management; Pollution management

Unveiling fusarium wilt resistance: insights from natural and artificial screening of tomato germplasm**Y Sravani¹, E Padma², K Mamatha³, M Ravindra Babu², T Naga Lakshmi⁴ and V Sekhar²**¹*Department of Vegetable Science, College of Horticulture, Dr.YSR. Horticultural University, Venkataramannagudem, India.*²*Department of Horticulture, College of Horticulture, Dr. YSR. Horticultural University, Venkataramannagudem, India.*³*Department of Horticulture, HRS, Kovvur, Dr. YSR Horticultural University, Venkataramannagudem, India.*⁴*Department of Plant Pathology, HRS, Dr.YSR. Horticultural University, Venkataramannagudem, India.***ABSTRACT**

Fusarium wilt, caused by *Fusarium oxysporum* f. sp. *lycopersici*, is a major constraint to tomato (*Solanum lycopersicum* L.) cultivation, leading to yield losses of up to 80%. This study evaluated 30 tomato genotypes, including 27 germplasm lines and three released varieties, for resistance to Fusarium wilt under both natural and artificial screening conditions during the rabi season of 2022-2023. Artificial inoculation was conducted using spore suspensions of 10^6 conidia/ml, while natural screening relied on field trials with susceptible checks to create disease pressure. Disease incidence and severity were

recorded on a 0-4 scale. Results indicated that two genotypes EC-631396 and Local collection exhibited high resistance (16.66% and 18.75% incidence, respectively) under artificial conditions, with no incidence in natural screening. Three genotypes (EC-806571, EC-611885, and EC-161245) showed moderate resistance, while others ranged from moderately susceptible to highly susceptible. These findings highlight the potential of resistant genotypes for breeding programs aimed at sustainable management of Fusarium wilt. Incorporating these genotypes can enhance productivity, reduce reliance on chemical controls, and promote eco-friendly agriculture.

Keywords: *Fusarium oxysporum*; resistance screening; germplasm; artificial inoculation; natural screening.

Organic Farming and Residue-Free Food Production

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ABSTRACT

Organic farming has emerged as a sustainable agricultural practice aimed at reducing the harmful impacts of chemical inputs on human health, soil fertility, and the environment. As global awareness increases regarding the dangers of pesticide residues in food, organic farming provides a viable solution to produce residue-free food while maintaining ecological balance. This approach relies on the use of natural inputs such as compost, green manure, biological pest control, and crop rotation to improve soil health and plant nutrition, without resorting to synthetic fertilizers and pesticides. The core objective of organic farming is to produce food that is free from harmful chemical residues, thus safeguarding consumer health. It emphasizes the integration of traditional knowledge with modern scientific techniques to promote soil biodiversity, conserve water, and reduce greenhouse gas emissions. Unlike conventional agriculture, which often results in chemical accumulation in soil and produce, organic farming ensures the use of biodegradable substances that do not leave toxic residues. Residue-free food production is not only critical for human consumption but also plays a vital role in maintaining ecological integrity. Organic standards and certification systems, such as those established by IFOAM (International Federation of Organic Agriculture Movements), USDA Organic, and India's NPOP (National Programme for Organic Production), ensure strict compliance with residue limits and quality standards. The increasing consumer demand for clean, safe, and healthy food is further accelerating the shift toward organic and residue-free farming practices globally. However, despite its numerous benefits, organic farming faces challenges such as lower initial yields, lack of awareness among farmers, higher input costs for organic alternatives, and complex certification processes. Addressing these issues through government support, farmer training, market development, and improved research on organic inputs can help scale up residue-free food production systems. In conclusion, organic farming is not just a method of cultivation but a holistic approach to agriculture that prioritizes long-term sustainability, soil and human health, and environmental preservation. The promotion of residue-free food through organic practices represents a critical step toward building a healthier, more resilient agricultural future. Investing in organic farming systems and encouraging consumer preference for organically grown produce can significantly contribute to a toxin-free food chain and ecological sustainability.

Keywords: *Organic farming; IFOAM; NPOP; biodegradable*

Temperature Extremes and Climate Impacts in Haryana, India**Kuldeep Singh, Shraddha Rawat***Department of Agronomy, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, India.***ABSTRACT**

Haryana, situated in the northwestern Indo-Gangetic plains of India, is increasingly experiencing climate-induced temperature extremes, which have significant implications for agriculture, ecosystems, and public health. This study investigates long-term trends (1980–2023) in extreme temperature indices—such as the frequency of extremely hot days (TX90p), warm nights (TN90p), cold nights (TN10p), and changes in the Diurnal Temperature Range (DTR)—across major districts of the state. The analysis reveals a consistent and statistically significant rise in maximum and minimum temperatures, with a particularly sharp increase in nighttime temperatures. As a result, the DTR is narrowing, indicating a warmer nocturnal climate that affects crop physiology and increases heat stress. Heatwave events, especially during the pre-monsoon season (May–June), have become more frequent, intense, and longer in duration, with districts like Hisar, Sirsa, and Bhiwani showing extreme thermal anomalies. Conversely, cold extremes in winter months are on the decline, signaling a shift in seasonal temperature patterns. These climatic changes have adversely impacted the growth and productivity of key Rabi crops, particularly wheat and mustard, due to shortened grain-filling periods and elevated heat stress during anthesis. Temperature extremes have a greater relationship with yield anomalies than precipitation extremes, and irrigation helps to buffer the detrimental consequences of high temperatures.

Keywords: *Climate change; Diurnal Temperature range; Haryana; Heatwave; Temperature Extreme*

Multidimensional evaluation of Chickpea Accessions: Morphological Traits and Fusarium Wilt Resistance Dynamics**Monika Patel, Monika Jyoti Kujur and Anita Babbar***Genetics and Plant Breeding, JNKVV, Jabalpur, India.***ABSTRACT**

Chickpea (*Cicer arietinum* L.) serves as a major pulse crop worldwide, experiencing substantial yield losses due to Fusarium wilt, a serious soil-borne disease caused by *Fusarium oxysporum* f. sp. ciceris. In the Rabi season of 2023–24, 1,500 chickpea accessions obtained from ICARISAT, Hyderabad, were evaluated at JNKVV, Jabalpur. Agro-morphological traits and screening against Fusarium wilt. The accessions exhibited notable phenotypic variability for morphological traits, viz., pink (1387)- white flower (113), semi-erect (1,456)- erect (44) growth habit, and peri-pinnate (1,495)- Simple (5) leaves. The accessions were categorised based on seed shape and seed size in Desi type (1,393) and Kabuli type. The phenological traits, viz., 50% flowering ranged from 60–73 days and maturity from 86–115 days. The accessions have a wide range of variation in plant height, ranging between 15.5–54.3 cm. Field evaluation under artificially inoculated Fusarium wilt sick plot conditions classified the 1,500 chickpea accessions into different categories of disease and identified 44 resistant, 56 moderately resistant. The integration of morphological and pathological evaluation enabled the identification of genetically diverse and wilt-resistant accessions. These lines serve as potential donors for future breeding programs aimed at improving Fusarium wilt resistance and agronomic performance in chickpea.

Keywords: *Fusarium wilt; morphological diversity; climate resilience; chickpea breeding; germplasm evaluation*

Exploration of *Zanthoxylum armatum* DC. (Timur) populations for IUCN categorization and evaluation of anthropogenic impact in Western Himalayan region**Neha Chaudhary, J. S. Butola, Priya Bansal***Department of Forestry and Natural Resources, H.N.B Garhwal University, Srinagar, Uttarakhand, India.***ABSTRACT**

Zanthoxylum armatum DC., commonly known as Timur, is a high-value medicinal and aromatic plant native to the Himalayan region, renowned for its ethnobotanical and economic significance. This study investigates the occurrence, distribution, and population dynamics of *Z. armatum* across selected sites in the Western Himalayas, with a focus on IUCN categorization and evaluation of anthropogenic impacts affecting its natural habitats and the species. Comprehensive field surveys and geo-referenced sampling along altitudinal gradients were employed to assess population density, regeneration status, and habitat preferences. The results indicate a fragmented distribution and declining population, primarily attributed to unsustainable harvesting practices, habitat degradation, land-use change, and increasing incidents of forest fires indicating its populations being Vulnerable to Critically Endangered as per IUCN categorization. The lack of conservation awareness and community engagement further exacerbates the species' vulnerability. These findings underscore the urgent need to adopt integrated conservation strategies and promote the sustainable utilization of *Z. armatum* as a natural resource.

Keywords: *Timur; Conservation; Sustainability; Anthropogenic impact; Habitat degradation; Forest fire*

Evaluation of Traditional and Modern Water Conservation Practices in Mitigating Drought in Shrigonda Tahasil**¹Ravikant S Shitole, ²Kalyani A Khetmalis***¹Department of Geography K.J Somaiya College of Arts Commerce and Science Kopargaon, Mohaniraj Nagar, [Affiliated to Savitribai Phule Pune University], Pune, India.**²Department of Geography Prof.Ramkrishna More Arts, Commerce and Science College Akurdi Pune [Affiliated to Savitribai Phule Pune University], Pune, India.***ABSTRACT**

Lack of water is a major hurdle that can be faced in this semi-arid area of Shrigonda Tahasil in the Ahmednagar district of Maharashtra. The shrewd monsoon and recurring droughts are a threat to agriculture and livelihood. In this analysis, conventional and innovative ways of water saving are evaluated for their capability to enhance water supply and resilience. Earthen structures like checkdams, percolation tanks and farm ponds and traditional know-how have supported GP-scale groundwater recharge and community-driven water management. Over time, new-age interventions such as drip irrigation, recharge shafts and watershed development have improved water-use efficiency and drought management. The findings, from field surveys, stakeholder interviews, and secondary sources, underscore the complementary benefits to be gained from incorporating both approaches. Results indicate that the integrated use of traditional systems with modern technologies effectively enhances the sustainability of groundwater, agricultural yield and drinking water security. Active involvement of the communities in sound water management can influence decentralised administration and institutional support. The research advocates the integration of watershed planning, conjunctive use of surface and groundwater, encouragement of water-efficient irrigation, crop diversity, and farmer training. Policy convergence across sectors must be reinforced for long-term resilience. The findings highlight that locally adapted hybrid water conservation models are essential for the sustainable development of water-scarce regions such as Shrigonda.

Keywords: *Water Conservation; Groundwater Recharge; Traditional Practices; Drought Resilience; Integrated Management*

Feeding and Reproductive Biology of *Mystus vittatus* (Bloch, 1794) from Shakri Maun, North Bihar, India**Amit Verma, Adita Sharma, Tanushri Ghorai, Roshan Kumar Ram, Pravesh Kumar***College of Fisheries, Dholi, RPCAU, Pusa, Bihar, India.***ABSTRACT**

The investigation was carried out from November 2020 to June 2021 to study the biology of selected fish species belonging to the family Bagridae from Shakri Maun, Muzaffarpur district, North Bihar. The study focused on the feeding biology (food and feeding habits, and gastro-somatic index) and reproductive biology (gonado-somatic index and fecundity) of the most abundant species. In the present investigation, three fish species from the family Bagridae, belonging to the order Siluriformes and one genus, were identified from the sampling site at Shakri Maun. *Mystus vittatus* (Bloch, 1794) was the most abundant among the three species and was present throughout the study period. The index of preponderance for the stomach content of *Mystus vittatus* indicated that fish and their body parts dominated the diet, accounting for approximately 48.39%, followed by crustaceans (22.56%), insects and their parts (9.57%), molluscs (6.19%), worms (3.84%), digested or unidentified matter (3.81%), mud and sand (2.19%), plant matter (1.8%), and bivalves and larvae (1.65%). The gastro-somatic index of *Mystus vittatus* was estimated monthly and ranged from 1.32 ± 0.01 (June, 2021) to 2.5 ± 0.04 (May, 2021) for females, and 1.25 ± 0.02 (June, 2021) to 2.11 ± 0.04 (May, 2021) for males. The stomach content analysis revealed that the species is carnivorous by nature. The current investigation revealed a slightly lower than ideal male-to-female ratio (0.64:1), indicating female dominance. Monthly variation in the mean gonado-somatic index ranged from 0.79 ± 0.02 (December, 2020) to 3.05 ± 0.14 (June, 2021) for males, and from 1.1 ± 0.02 (December 2020) to 11.01 ± 0.87 (June 2021) for females. The peak gonado-somatic index observed in June indicated the onset of spawning in *Mystus vittatus*. Relative fecundity of 10 mature gravid female *Mystus vittatus* was calculated, ranging from 5,182.17 to 18,625.12 eggs, with an average of $10,938.79 \pm 4,959.63$ eggs.

Keywords: *Feeding; Reproductive Biology; Mystus vittatus; Shakri Maun; North Bihar***Alleviation of Abiotic Stress in Wheat through Zinc Fertilization****Naresh Kumar, Ronak Kuri and Naleeni Ramawat***Agriculture University, Jodhpur, Rajasthan, India.***ABSTRACT**

Wheat productivity is increasingly constrained by various abiotic stresses such as drought, heat and soil nutrient deficiencies, which are further exacerbated by climate change. Among these, micronutrient imbalance, particularly zinc (Zn) deficiency, significantly impairs plant physiological functions, leading to reduced growth, yield and grain quality. Zinc plays a crucial role in several enzymatic activities, photosynthesis and hormone regulation, thereby enhancing the plant's tolerance to abiotic stress. This abstract explores the role of zinc fertilization through soil application, foliar spray and seed priming in mitigating the adverse effects of abiotic stress in wheat. Several studies have shown that appropriate zinc supplementation improves water use efficiency, membrane stability antioxidant activity and nutrient uptake in wheat under stress conditions. The integration of zinc fertilization into nutrient management strategies not only enhances crop resilience but also contributes to sustainable wheat production and food security in stress-prone agro-ecosystems.

Keywords: *Wheat; Abiotic stress; Zinc fertilization; Drought tolerance; Micronutrient management; Climate resilience*

Effect of Integrated Nutrient Management on Growth and Yield of Tomato (*Solanum lycopersicum* L.) Under Kharif Conditions**Kulendra Singh Yadav, Richa***Rajmata Vijayaraje Scindia Kirishi VishwaVidyalaya, Gwalior, Madhya Pradesh, India.***ABSTRACT**

Efficient nutrient management plays a vital role in enhancing crop productivity while ensuring soil health and long-term sustainability. This study aimed to evaluate the impact of integrated use of organic, inorganic, and biological nutrient sources on the growth and yield of tomato (*Solanum lycopersicum* L.) under field conditions. The experiment was conducted during the Kharif season of 2019–20 at the Horticulture Research Farm, College of Agriculture, Indore (M.P.), using a randomized complete block design with eight treatment combinations and three replications. The treatment T2—100% recommended dose of fertilizers (RDF; 100:50:50 NPK kg/ha)—significantly improved early flowering (41.67 days), 50% flowering (54.43 days), first fruit picking (82.07 days), plant height (114.03 cm), and biomass accumulation (fresh weight: 169.12 g; dry weight: 57.22 g). However, the highest yield and growth performance were observed under treatment T8, which combined 75% RDF with 25% organics (neem cake, vermicompost, FYM, poultry manure) along with biofertilizers (Azotobacter and PSB). This treatment recorded the highest number of branches (25.67), leaves (77.93), leaf area (360.58 cm²), fruits per plant (44.13), fruit size (5.52 × 4.93 cm), and fruit yield (269.44 q/ha). The findings highlight the potential of integrated nutrient management strategies in improving tomato yield and contributing to climate-resilient and sustainable agricultural practices, aligning with the goal of enhancing food and nutritional security under resource-constrained conditions.

Keywords: *Tomato; growth; INM; phenological characters; yield***Isolation And Screening of Zinc Solubilizing Bacteria from Pulse Rhizosphere In Calcareous Soils**
Ajeet Kumar^{*1}, Ramjas Meena², Sunita Kumari Meena³, Sanjay Kumar Singh⁴, Amaresh Chandra⁵ and Sudhir Paswan⁶¹PG Research Scholar, Department of Soil Science, Post Graduate College of Agriculture, Dr. Rajendra Prasad Central Agricultural University, Pusa (Samastipur)-848125, Bihar, India²Assistant Professor, Department of Soil Science, Sugarcane Research Institute, Dr. Rajendra Prasad Central Agricultural University, Pusa (Samastipur)-848125, Bihar, India³Assistant Professor-cum- Scientist, Department of Soil Science, Tirhut College of Agriculture, Dholi, Muzaffarpur, Dr. Rajendra Prasad Central Agricultural University, Pusa (Samastipur)-848125, Bihar, India⁴Dean, College of Basic Sciences and Humanities (CBS&H), Dr. Rajendra Prasad Central Agricultural University, Pusa (Samastipur)-848125, Bihar, India⁵Assistant Professor-Cum-Scientist, Department of Statistics and Computer Applications, CBS&H, RPCAU, Pusa⁶Assistant Professor-Cum-Scientist, Department of Statistics and Computer Applications, CBS&H, RPCAU, Pusa**ABSTRACT**

Calcareous soils often suffer from zinc (Zn) deficiency due to high pH and carbonate content, severely limiting pulse productivity. This study aimed to isolate and screen indigenous zinc solubilizing bacteria (ZSB) from rhizospheres of major pulses (mung bean, urd, pigeon pea, lentil, chickpea) grown in Bihar, India. Ten bacterial isolates (RJM-1 to RJC-10) were obtained via serial dilution from rhizosphere soil and screened using Tris-minimal agar containing ZnO, ZnCO₃, ZnSO₄, and Zn₃(PO₄)₂. Isolates RJL-8 and RJP-6 showed superior Zn solubilization with halo zone diameters of 27 mm and 26 mm, and solubilization efficiencies of 337.55% and 325.00%, respectively. Broth assays confirmed maximum Zn release (249.75 mg/L for RJP-6) and notable pH reduction (5.53 for RJL-8). Pot trials on lentil (*Lens culinaris* L.) revealed significant increases in grain yield (22.02 g/pot) and Zn content in grains (24.27 mg/kg) in T9 (ZSB1 + ZSB2 + 75% RDF ZnSO₄) treatment, performing equivalently to 100% RDF Zn.

These findings demonstrate the potential of ZSB in enhancing Zn availability and lentil productivity while reducing chemical input. Thus it is finally Concluded that Zinc solubilizing bacteria RJL-8 and RJP-6, isolated from lentil and pigeon pea rhizospheres, demonstrated remarkable Zn solubilization. Their application in lentil cultivation, combined with reduced ZnSO₄ (75% RDF), significantly improved yield, Zn uptake, and soil health, offering a sustainable alternative to full-dose chemical fertilization.

Keywords: *Zinc solubilizing bacteria; calcareous soils; lentil; rhizosphere; bio-inoculant; micronutrient; sustainable agriculture*

Induced Mutations for Early Maturity in Mungbean: A Pathway to Efficient Rice-Wheat Cropping

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ABSTRACT

Genetic improvement of mungbean (*Vigna radiata* L.) for early maturity offers a strategic solution to enhance productivity and sustainability with in Rice-Wheat Cropping Systems (RWCS). Induced mutations using physical and chemical mutagens have successfully generated early-maturing mungbean lines that fit within narrow cropping windows without compromising yield or nutritional quality. These improved lines reduce the growing period by 15–20 days, enabling efficient crop rotation, better resource utilization, and enhanced soil fertility through nitrogen fixation. Mutation breeding techniques, including LD₅₀ determination, have facilitated the selection of desirable mutants with short duration, high yield, and synchronous maturity. Integration of these lines into RWCS supports climate resilience, reduces fallow periods, and increases farmers' income. Multi-location trials and advanced molecular tools such as CRISPR/Cas9 are essential for further refinement and broader adaptability. The development of nutritionally enriched, climate-resilient mungbean varieties marks a significant advancement toward sustainable agriculture and food security.

Keywords: *Mungbean; Early maturity; Rice-Wheat Cropping System; Mutation breeding; LD₅₀; Genetic improvement; Climate resilience; Soil fertility*

Protein Fortified Banana-Jack Toffee: A Nutritious Confectionary

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ABSTRACT

India is a protein deficit country, especially among the youth. About 73% of Indian population suffers from malnutrition and poor muscle development. A staggering 73% of the population suffers from malnutrition and poor muscle development, highlighting a critical nutritional gap. Concurrently, a substantial amount of produce, specifically fruits like bananas and jackfruits, faces significant post-harvest losses. Approximately 30-40% of these fruits become unmarketable due to spoilage, primarily over-ripening during storage and transportation. Developing value-added products like fruit toffees presents a viable solution to extend the shelf life of these over-ripened fruits. This study aimed to develop banana-jackfruit toffees with added protein using such over-ripened fruits and their evaluation of physico-chemical characteristics and sensory attributes. Utilization of over-ripened fruits incorporate various nutrients that the fresh produces does not provide, additionally, protein fortification from both animal and plant sources addresses the prevailing problem of protein deficiency in India. In this experiment, the protein fortified banana jackfruit toffees were prepared using 10% added skimmed milk

powder, 2% added pulse powder and varying quantity of banana-jackfruit pulps, banana powder and flavourings. Addition of these protein sources increased the protein content in the toffees from 1.05% to 8.40%. Use of over-ripened jackfruits enhanced the total phenolic acid content in the prepared toffees from 96.95 to 298.10 mg/100gGAE. Treatment with 5% banana powder and 50:50 ratio of banana:jackfruit pulp with added coffee + cocoa flavouring (@1% each) showed better marketability and consumer acceptability overall. This research demonstrates the potential for a commercially viable, protein-fortified, ready-to-eat (RTE) confectionary product that not only reduces food waste but also contributes to improving nutritional outcomes in India.

Keywords: *Banana; Jackfruit; Protein; Enrichment; Toffee*

Heavy Metal Contamination in Iron Mines of the Chotanagpur Plateau: Environmental and Human Health Perspectives

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ABSTRACT

Mining significantly contributes to economic growth and development across the world. India possesses some of the largest and richest iron ore deposits, particularly in Jharkhand and Odisha. However, rapid iron ore mining in this region has resulted in the accumulation of potentially toxic metals in agricultural soils, posing serious risks to both the environment and human health. Additionally, the microbiota in these soils is under constant metal stress. To assess the extent of metal pollution and its impact on the soil microbial community, 100 topsoil samples were collected from agricultural fields surrounding an iron ore mine at the Jharkhand-Odisha border. The initial investigation revealed that regions with the highest concentrations of toxic metals (Fe, Mn, Cu, Cd and Cr) exhibited significantly lower microbiological activity. Several metals were found at concentrations exceeding permissible limits (Fe: 647529 ± 91468 mg/kg; Mn: 5703.8 ± 1560.5 mg/kg; Cd: 22.3 ± 3.6 mg/kg). Furthermore, a negative correlation was observed between soil metal concentrations and microbial activity (as indicated by biomass carbon, soil respiration, fluorescein diacetate hydrolysis, and dehydrogenase activity). The soil quality index confirmed the influence of anthropogenic activities on metal contamination. This study highlights the detrimental effects of heavy metal contamination on soil microbiota and helping researchers in designing sustainable agricultural practices to mitigate environmental risks.

Keywords: *Iron ore mines; potentially toxic metal, microbe; soil quality index; microbial properties*

Response of Nepalese barley landraces under heat stress condition in Madhesh Province of Nepal

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ABSTRACT

Heat stress was a serious challenge for global agricultural productivity, caused due to increasing temperature hinder the production and food security. Heat stress has detrimental effect on plant physiology, metabolic activities, reproductive stage and ultimately to the yield. The goal of the present study was to assess the heat stress of barley genotypes and estimated grain yield. The evaluation was done on 21 barley genotypes at different sowing times under heat stress conditions in 2024/25 season with 3 replications in strip plot design at experimental field of CNRM, Bardibas. The plot size was 0.5m^2 per genotype and replicate twice. Yield and yield attributes were measured at the time of harvest. The data were entered in MS excel 2007 and interpreted in MS word 2007 and analyzed by Genstat ver 2018. The data revealed that few yield attributes traits had significantly influenced by the date of

planting and genotypes except yield. However, the yield of barley dropped in late sown by 24 %. AFU202501 (212.5 g/plot) showed prominently followed by NGRC 5984 (115.8). The spike length was found higher on 10th Dec and lasted on 10th Jan. The spike length ranged from 6.89-9.09. in conclusion, the barley landraces cultivating till Jan 10 can produce significant yield and productivity showed more resistant so, further research regarding the genetic potential should be conducted for verification.

Keywords: *Barley; heat stress; yield attributes; spike; landraces*

The Carbon Cost of Clean: A Life Cycle Perspective on the Environmental Impact of Skincare Routines

Kajal Sorout

Independent Researcher

Abstract

This paper explores the often-overlooked carbon footprint of daily skincare routines through a life cycle assessment (LCA) framework. While clean beauty has become a symbol of conscious consumption, the environmental impact of its production, packaging, transportation, and disposal is rarely quantified in consumer conversations. From the raw material extraction of natural ingredients to the energy-intensive manufacturing processes and plastic-heavy packaging waste, every step contributes to greenhouse gas emissions. Through analysis of commonly used products like cleansers, toners, serums, and moisturizers, this paper reveals how even minimalist routines can carry hidden environmental costs. It examines emissions associated with various skincare ingredients, compares traditional vs. clean beauty supply chains, and evaluates the role of consumer behavior, brand practices, and greenwashing in perpetuating unsustainable cycles. The paper also provides practical recommendations for consumers and formulators to reduce carbon impact without compromising skin health. Ultimately, it urges a shift from appearance-based marketing to transparency, circular design, and truly sustainable innovation in skincare.

Introduction

In recent years, clean beauty has emerged as a global trend, promoting products with natural ingredients, non-toxic formulations, and minimal environmental impact. However, the narrative surrounding clean beauty often overlooks the full carbon cost associated with product life cycles—from raw material extraction to end-of-life disposal.

Objective

This paper aims to explore the total environmental impact of skincare routines, particularly clean beauty products, by examining each phase of a product's life cycle. It aims to bring transparency to consumer choices and recommend ways to minimize the carbon footprint of daily routines.

Methods

A qualitative life cycle assessment (LCA) approach was employed to analyze common skincare items such as cleansers, exfoliants, serums, and moisturizers. Emissions from sourcing, manufacturing, packaging, transportation, and waste disposal were estimated based on existing environmental reports, scientific literature, and industry databases.

Results

The study found that clean beauty products, despite their branding, often carry comparable or higher carbon costs due to the demand for rare botanical ingredients, excessive packaging, and international supply chains. Key findings include:

- Packaging (especially glass and virgin plastic) contributes up to 40% of total emissions.
- Transportation, particularly for imported exotic ingredients, significantly adds to carbon output.
- Water usage during production and daily use remains a hidden but impactful factor.

Conclusion

While clean beauty promotes ethical and eco-conscious consumption, the true environmental footprint of these routines is complex. Both consumers and manufacturers need to rethink priorities—emphasizing carbon transparency, local sourcing, minimalist routines, and refillable packaging. Redefining ‘clean’ to include low-emission processes can guide the beauty industry toward meaningful sustainability.

Recommendations

1. Encourage carbon labeling on skincare products.
2. Support brands using local ingredients and minimal packaging.
3. Educate consumers about overconsumption and lifecycle impact.
4. Promote refillable and recyclable packaging systems.

Impact of Integrated Tribal Development Project Office Schemes on Economic and Social Development of Tribal Community in Akole Tehsil

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ABSTRACT

Tribal people are native population in that Geographical region. Akole Tehsil is a tribal area of Ahmednagar district. Most of population is Koli Mahadev, Bhil and Thakar Scheduled Tribes. Economy of this tribal population is very backward. For the purpose of rural development, government of Maharashtra has implemented many policies for tribal development. Mostly this policy is based on rural, social and economic development. By adopting this policy there are a lot of development in number of the field, in this research paper, there is study and observation of this Maharashtra government policy for tribal project office development.

The final responsibility of implementing the tribal development schemes has been given to the 29 Integrated Tribal Development Offices in Maharashtra. The economy of the tribal community is still limited to providing livelihood, and there is a need to accelerate their development. The provisions of the Act have inspired the tribals to participate in political, social, economic, and developmental activities. These include schemes for educational development, economic development, agricultural development, special central assistance schemes, and others. The government has issued strict guidelines for the implementation of these schemes. Therefore, the tribal community faces difficulties in taking advantage of these schemes. The development schemes provided by the central and state governments to the tribal community show a change in the economic and social development of the tribal community.

Keywords: *Geographical region; Government policy; Integrated Tribal Development Offices; Scheduled Tribes*

Introduction

Ahmednagar district is largest district of Maharashtra state. It is tropical region. Geographical location of Ahmednagar district is $19^{\circ}15' 14''$ N to $19^{\circ} 44' 59''$ N latitude and $73^{\circ} 37' 00''$ to $74^{\circ} 07' 24''$ E.¹ (Maharashtra State Gazetteers - Government of Maharashtra, Ahmednagar District, 1976, P.1.) Ahmednagar district last tehsil is Akole Tehsil. It is bounded by Sangamner Tehsil to the east, Igatpuri Tehsil to the west, Junnar Tehsil to the south, and Sinnar Tehsil to the north.² (Maharashtra State Gazetteers - Government of Maharashtra, Ahmednagar District, 1976, P.6.) The western part of the taluk is on the foothills of the Sahyadris, and the eastern part is flat. The district is geographically divided into two parts. (i) Western Hilly Region (ii) Eastern Plain Region the Tehsil has a total of 187 villages, out of which 106 villages are under tribal administration, out of which 42 villages are of a hypersensitive nature. All the villages are located in the western part of the district.

Due to the large area, of this district, there are lot of variation in the climatic condition. Some part of this district is a dry and semi-arid condition as the Jamkhed, Shrigonda, Karjat and Pathardi. But Akole Tehsil has good rainfall due to the location surrounded by the Sahyadri ranges. There is a Kalsubaishikher whose height is 1646 meter. This is highest location of Maharashtra state. Due to the heavy rainfall more than 150 Cm. It has good vegetation for biodiversity.

In Akole Tehsil, most of population is tribal population of the Koli Mahadev, Bhil, and Thakar community.³ **(Dr. Govind Gare, 1974, Sahyadritil Adivasi)** This population is primitive people of this location. This population is tribal that's why economic development has the limitation. Last some decade, state and central government has implemented number of schemes like as

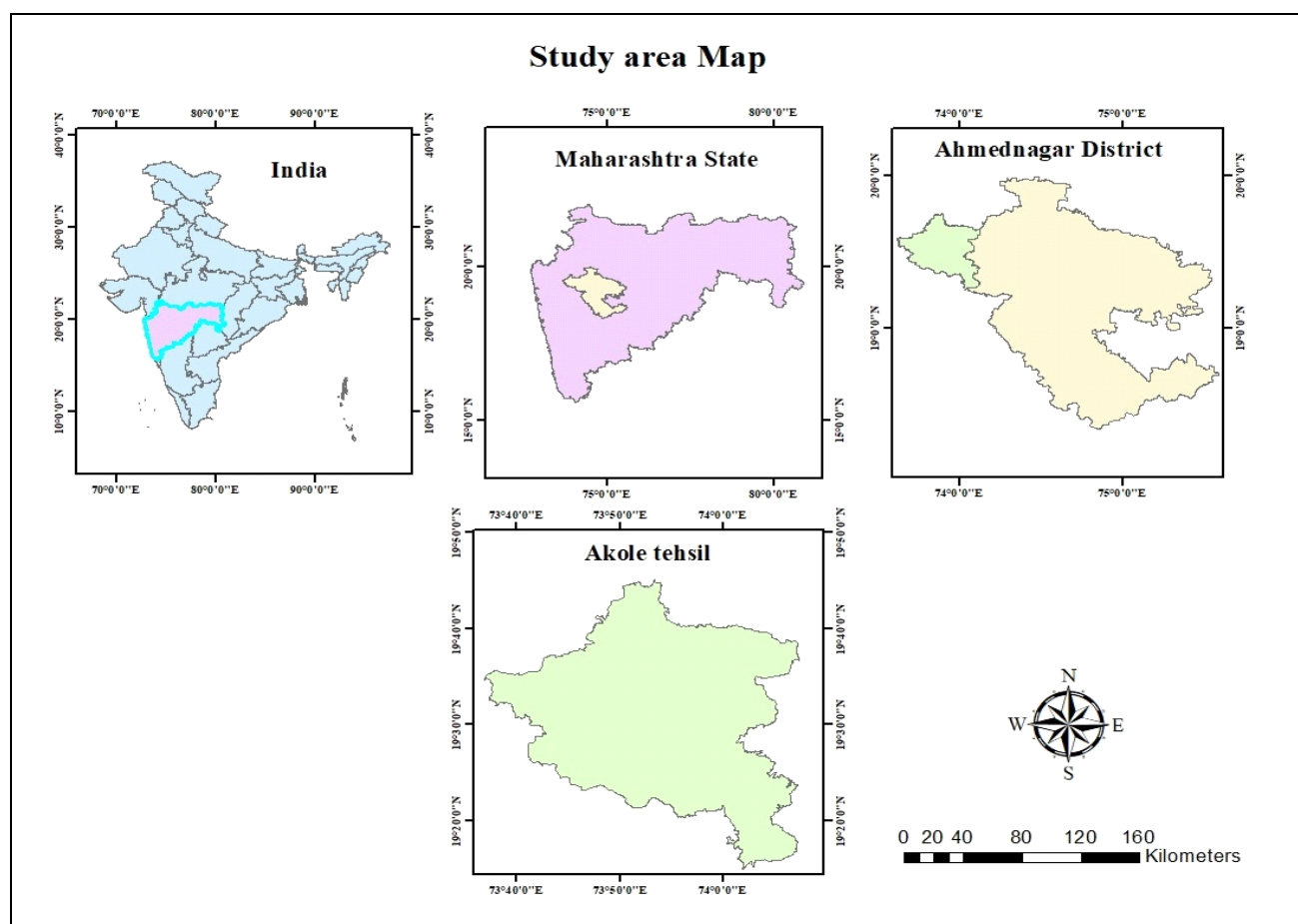
1. Thakkar Bappa Adivasi Vastisudhar (2021-22).
2. Bhumihiin anusuchit jamatichya shetmajur kutumbasathi swabhiman v sabalikaran yojana (2007-08).
3. Anusuchit jamatichya shetkaryana vjipamp/telpamp puravine (1972-73).
4. Anusuchit jamatichya shetkaryana sinchnasathi HDPE pipe puravine (2007-08).
5. Bhartsarkar shishyavritt iyojana (1959-60).
6. Anusuchit jamatichya kutumbana dudha ljanavranche vatap karne (2005-06).
7. Anusuchit jamatichya kutumbakarita gharkul yojana (2003-04).
8. Anusuchit jamatichya kutumbakarita gharguti Gas sanchcha puravtha (2005-06).
9. Khavati karj yojana (2012-13).
10. Anusuchit jamatichya mula /mulinsathi shasakiy Aashramshala va Vasatigruh suru karane (1972-73).

It has good result for this government project. Living condition of this population had made the improvement. People have good health, education, agriculture development.

Tribal population of research Area:

Akole Tehsil extends from 19°30' N to 19°40' N longitude and 74°00' E to 74°05' E longitude, and the total geographical area of Akole Tehsil is 1488.2 sq km.² **(Maharashtra State Gazetteers - Government of Maharashtra, Ahmednagar District, 1976, P.5.)** Tribal people are native population of that geographical region. These people are living by last number of generations. In India there are 8.6% of tribal people. In our Maharashtra major tribal tribes are Mahadev Koli, Bhil, warli, Katkari, Thakar. This tribal population is 7% Maharashtra state. Most of this tribal people economy is based on the agriculture activity. But in the past period, there was shifting agriculture.

In Akole Tehsil of the Ahmednagar district. There are these above population as the Mahadevkoli and Thakar. In this hilly region these people are working in agriculture activity. This whole agriculture is based on monsoon rainfall. That's why economy is not good as we have considered. For the purpose of social and economic development of this tribe, government of India and state government have applied different kinds of rural and tribal development projects.



Location Map of the Study Area

Government Implemented Scheme:

There is larger history for government has implemented from British rule in India. British government has forced on forest and revenue based. But Government of India has weightage on human resource development view. In India total population of this tribal population is the 8.6%. Most of this scheme has applied for the purpose of social, economic, transportation, agriculture, education, health, tourism, trade and transportation. These schemes are as below.

Sr. No.	Title Of Scheme	Year of Implement
1	Thakkar Bappa Adivasi Vastisudhar yojana	2021-22
2	Bhumihin anusuchit jamatichya shetmajur kutumbasathi swabhiman v sabalikaran yojana	2007-08
3	Anusuchit jamatichya shetkaryana va vijpamp purpamp puravine	1972-73
4	Anusuchit jamatichya shetkaryana sinchnasathi HDPE pipe puravine	2007-08
5	Bhartsarkar shishyavritt iyojana	1959-60
6	Anusuchit jamatichya kutumbana dudha ljanavranche vatap karne	2005-06
7	Anusuchit jamatichya kutumbakarita gharkul yojana	2003-04
8	Anusuchit jamatichya kutumbakarita gharguti Gas sanchcha puravtha	2005-06
9	Khavati karj yojana	2012-13
10	Anusuchit jamatichya mula /mulinsathi shasakiy Aashramshala va Vasatigruh suru karane	1972-73

Source: Government of Maharashtra Tribal Project office

These above scheme and project funded by central and the state government. Government has implemented this above scheme as the need of the tribal population in this geographical region.

Result and Discussion

Government Project and Tribal Development:

Various schemes are being implemented by the central and state governments for the overall development of tribal communities in rural areas. They can be specified as follows:

Agriculture Related Scheme

Most of this scheme was related for agriculture and social and educational development. Government of Maharashtra provide in 2007-08 Bhumihin Sabalikarn Yojana, in which the employment was provide for the tribal people. Employment made self-Development for these tribal people. Now a day the main occupation of these tribal people is agriculture. Other purpose of agriculture and economic development it has need of the irrigation facility. State government has support of electric connection and Pump of the tribal population. Milk is good food. It can be generating the good economy for these tribal populations. Government has funded for the purpose of milk animal in this region. This milk made dairy production in rural food processing activity.

The government provides subsidies to the tribal community to start businesses like animal husbandry, dairying, and fisheries as a link to agriculture. Land development works, sapling protection, repair of old wells, supply of bullock carts, digging of new wells, laying of pipelines up to 300 meters, supply of tarpaulin, wire fencing, supply of Tushar/drip irrigation sets, etc. Therefore, farming in the tribal community has started to be done in a modern way. The income from traditional farming is very low. But modern farming methods have increased the yield. With the increase in agricultural income, the economic condition of the tribal community has improved.

Irrigation Related Scheme

Most of irrigation network made by pipe. The plastic pipe is a need of this tribal population. As per that view, Maharashtra government has funded for the HDPE pipe facility. There is a need for modern technology to increase agricultural production. The Government of India has implemented the 'pani aadva pani jirva' scheme in the hilly areas. This increases the groundwater level and improves irrigation. Under the project office, electricity and oil pumps are supplied to the farmers. In the tribal areas, water is made available for agriculture by building small and big dams. Schemes like drip and drip are implemented as income is low due to lack of water. This will boost agricultural yield and also the income of farmers.

1.3 Human Settlement Related Scheme

Salter is a need of every human being. In this tribal area, there is heavy rainfall. As per view State and central government is going to provide the fund for there's villager for the Gharkul Yojana. Thakar Bapa yojana was for improvement for development in the tribal settlement. It has made construction as the tribal villages. There is sufficient amount for the house contortion activity. For tribal women, there is scheme as the fuel for cooking. Central government is supplying the HP gas for tribal cooking activity. It gives best responses by tribal women in monsoon rainfall period. It also saves forest cutting and forest conservation.

1.4 Economic Related Scheme

Education is one of the best facilities for tribal student. As per view of its government has support of the scholarship at school and college level. Number of students is taking benefit of this scholarship in the higher education. Economic condition of tribal people is very low. For the financial upliftment of the tribal people, government bank supply credit for agriculture and other employment activity. This scheme made self-sufficient for tribal population.

In the tribal areas, advances are provided for agriculture through many credit institutions. New seeds, new tools, and new technology are being used for the development of agriculture. This has led to development. Their economic and social development has been promoted.

Education Related Scheme

Education is best activity for nation and state develop. For the purpose of educational development in the tribal student, it gives Ashram School and boys and girls government hostel. This scheme made good social and economic development in the tribal area.

Education is the most important factor for the rapid development of the Scheduled Tribes living in the hilly areas of extremely inaccessible and extremely Backward. The government established residential Ashram School for tribal students from 1973-74 in these tribal areas. The main objective is to inculcate interest in education among tribal boys and girls so as to create educational awareness among the community in remote and hilly areas. The main objective of this scheme is to empower them academically and enhance their quality of life.

In an extremely inaccessible area of Akole tehsil, primary Ashram School, secondary Ashram School, higher secondary Ashram School, and separate girls Ashram School schools have been established. All facilities are provided to the students of the Ashram School. All school supplies are provided. Separate classrooms and dormitories have been constructed.

As a result, the students of the tribal areas have developed a taste for education, and their literacy has increased significantly. Advances in education have led to changes in their living conditions and a significant increase in their economic income.

1.6 Health Related Scheme

Health is the most basic need. The tribal people living in remote areas do not have access to adequate health facilities. A lot of efforts are being made at the government level to improve the health of the people in rural areas. The disease is most prevalent in rural areas. The government also runs various schemes for this. The Government of India has established rural hospitals in tribal areas to provide health facilities. Food, lodging, and other facilities are provided to the patients in rural hospitals and primary health centers. Subsidies for the production of medicines are provided to health institutions located in rural areas.

Public programs such as the National Malaria Eradication Program, Polio Immunization Program, Vision Donation Scheme, Primary Health Center and Sub-Center Construction, Rural Hospital Construction, etc. are organized in rural areas. All sections of the tribal society benefited, and there was a major change in their health and lifestyle. This changed the way of life in rural areas.

Conclusion

Hence since the last sixty-year government of India and Maharashtra had made number scheme for tribal, forest, water, education, social and economic development. For the purpose of political development, it has made reservation in parliament and state assembly. There is good scope for development for tribal in India.

Under the central and state governments, many efforts are being made at the government level for the upliftment of tribal communities in rural areas. The main objective of all these elements is to achieve economic, social, cultural, and political development of the tribal society. The most important factor in the development of rural areas is education, which is considered the foundation of their development. Students who have studied through schools started in tribal areas go on to add to their economic output by taking up jobs and businesses in different places.

With the schemes given for agriculture, their traditional agricultural practices changed, and modern methods of farming started. This has led to an increase in agricultural productivity. Cultivation of cash crops began in rural areas. All these factors have had an impact on the economy of rural areas, boosting their economic and social development.

Influence of Environmental Factors on the Development of Downy mildew (*Sclerospora graminicola*) in Pearl millet**Surjeet¹, JP Bishnoi², JR Verma¹, KK Saini¹ And Megha Jaimini¹**¹*Department of Plant Pathology, CoA, Agricultural University, Jodhpur, India.*²*ICAR-AICRP on Pearl millet, Department of Plant Pathology, ARS, Agriculture University, Jodhpur, India.***ABSTRACT**

Pearl millet (*Pennisetum glaucum* L.) is a monocot species belongs to the family Poaceae and sub family Penicledae, having diploid genome ($2n=2x=14$). It is locally known as Bajra, is also known as bulrush millet, cat tail or spiked millet. The soil-borne oospores or sexual spores of *S. graminicola* are the primary source of inoculum for the development of downy mildew. Climatic variables play a major role in the initiation and spread of plant diseases. Host, climate, biotic and edaphic factors influence the process involved in pathogenesis. During cool and humid nights, systemically downy mildew infected leaves produce abundant sporangia on the abaxial surface. However, the hot and dry environmental conditions favourable for pearl millet growth may not be conducive for sporangial production and survival. Environmental factors like temperature, rainfall, relative humidity, wind, dew, cloudiness and duration, quality and intensity of radiation play an important role in the development and spread of downy mildew. The present study was undertaken during Kharif, 2022 to find out the effect of different weather variables on the development of downy mildew in pearl millet. The data of downy mildew incidence for consecutive one year revealed that the mean weekly disease incidence in 7042 S ranged from 5.45 to 81.82 per cent indicating the highly susceptible response. The second fortnight of August to the first fortnight of September can be considered as window period for downy mildew incidence. The disease incidence in cultivar 7042 S was correlated highly significantly and positive correlation with maximum temperature ($r = 0.753$), highly significantly and negative correlation with total rainfall ($r = -0.744$). Evening relative humidity ($r = -0.602$), morning relative humidity ($r = -0.625$) and rainy days ($r = -0.624$) was significant and negatively correlated with downy mildew incidence. The minimum temperature showed non-significant and negative correlation (-0.309) with downy mildew disease incidence. It has been observed that multiple correlation (R) value 0.941 indicating a strong association between per cent disease incidence and weather parameters. The co-efficient of determination (R^2) of 0.886 proved the significance of overall regression model accuracy. Predict the occurrence of downy mildew with $R^2 = 0.886$, indicating that all weather parameters contributed 88.6 per cent towards disease development.

Keywords: Downy mildew; pearl millet; disease incidence; weather variables; correlation; regression**Bioefficacy of Paraquat Dichloride 24% SL on weed control of grapes and its residual effect on succeeding blackgram crop under Red and Laterite Zone of West Bengal****Madhab Kumar Datta^a, Champak Kumar Kundu^b and Rasmirekha Pattnaik^a**^a*Department of Agronomy, Faculty of Agriculture, Sri Sri University, Sri Sri Vihar, Bidyadharpur, Cuttack, Odisha, India.*^b*Department of Agronomy, Faculty of Agriculture, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal, India.***ABSTRACT**

Field experiments were conducted at Regional Research Substation under Bidhan Chandra Krishi Viswavidyalaya, Sekhampur, Birbhum, West Bengal during summer season of 2017 and 2018 to evaluate the bio-efficacy of Paraquat Dichloride 24% SL against weeds and phytotoxicity on grapevine and soil microflora. The experiment was tested under randomized complete block design with three

replicates. Among the herbicides, highest weed control index and weed control efficiency were recorded with Paraquat Dichloride 24% SL @ 1000 g a.i. ha⁻¹ which did not impart any phytotoxic symptoms in grapevine. The soil microbial population decreases initially after application of different doses of the herbicide but recovered gradually till harvesting. However, the highest berry yield (16.46 t ha⁻¹) was obtained with the application of Paraquat Dichloride 24% SL @ 1000 g a.i. ha⁻¹ which was statistically at par with twice hand weeding. It was also observed that the herbicides tested on grapes, had no distinct residual effect in terms of the germination %, phytotoxicity and yield of the succeeding blackgram crop. From these findings it can be concluded that the application of Paraquat Dichloride 24% SL @ 1000 g a.i. ha⁻¹ can be recommended for effective weed management in grapevine in the study area.

Keywords: *Paraquat Dichloride; grapevine; weed management; hand weeding; phytotoxicity*

Forest Landscape for Climate Mitigation: Carbon, Climate, and Community Perspective

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ABSTRACT

Forests play a critical role in global climate mitigation by acting as carbon sinks, regulating local and regional climates, and sustaining livelihoods. Forest landscapes have potential as a nature-based solution to climate change, emphasizing three interconnected dimensions: carbon, climate, and community. From a carbon perspective, forest ecosystems contribute significantly to carbon sequestration and storage, with afforestation, reforestation, and avoided deforestation being key strategies. The climate dimension highlights how forests influence weather patterns, moderate temperatures, and enhance ecosystem resilience in the face of extreme climatic events. However, forests are under threat due to deforestation, land-use change, and unsustainable practices. These pressures reduce their capacity to mitigate climate impacts. Equally important is the community perspective, which underscores the role of forest-dependent populations in conservation efforts and the importance of equitable benefit-sharing. The integration of traditional ecological knowledge, community-based forest management, and inclusive policy frameworks can enhance both ecological and social outcomes. This study advocates for a landscape-level approach that balances ecological integrity with socio-economic needs, positioning forests as central to achieving climate targets and sustainable development goals. Integrated forest landscape approach—combining ecological restoration, climate planning, and community participation—can offer long-term solutions. Overall, forest landscapes must be viewed as systems that connect people, nature, and climate. Protecting and restoring these landscapes is not only essential for reducing greenhouse gases but also for improving biodiversity, water security, and livelihoods. Policies that support local governance, fair benefit-sharing, and climate finance are needed to make forest-based climate mitigation successful and sustainable.

Keywords: *Forest; climate mitigation; nature-based solution; carbon sink; community participation; equitable benefit - sharing*

Impact assessment of engineered Nano-Titanium Dioxide polymorphs priming on seed germination, growth and oxidoreductase enzyme activities of seedlings of Kidney Bean (*Phaseolus vulgaris* L.)**Alpana Paul^{1,2}, Priyanka Raha¹, Surendra Singh Jatav¹**¹*Dept. of Soil Science and Agricultural Chemistry, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh, India.*²*Faculty of Agriculture, Medicaps University, Pigdambar, Rau, Indore, Madhya Pradesh, India.***ABSTRACT**

Nanotechnology opens a large scope of novel application in the fields of biotechnology and agricultural industries, because nanoparticles (NPs) have unique properties, i.e., high surface area, high reactivity, tunable pore size and particle morphology. TiO₂-NPs are effective photocatalyst under ultraviolet-radiation and induces oxidation-reduction reactions, therefore TiO₂-NPs at appropriate concentration may improve the efficiency of plant photosynthesis and related physiological activities. A laboratory study was performed to observe the effects of nano-TiO₂ polymorphs priming on seed germination, seedling growth and antioxidant enzyme activities of Kidney bean (*Phaseolus vulgaris* L.). Nano-TiO₂ polymorphs i.e. anatase and rutile, were synthesized by the sol-gel method using titanium tetraisopropoxide as Ti-precursor and 2-propanol as solvent. Seeds of kidney bean were treated with nine different concentrations (in water) of each nano-TiO₂ polymorphs (0, 0.10, 0.25, 0.50, 0.75, 1.00, 1.50, 2.00 and 2.50 %) by soaking in different concentrations suspension (prepared by ultrasonication method) for 24 hours. The percentage of seed germination, seed germination index, seedling fresh weight, seedling dry weight were evaluated at 15 days following paper towel method of germination. Also the growth of seedlings and activity of antioxidant enzymes i.e. catalase and peroxidase were assessed at three weeks. The results showed that increase in concentration of each nano-TiO₂ polymorphs caused a significant increase in root and shoot length (79-97%) as well as number of lateral roots of the seedlings of kidney bean. The findings illustrated the beneficial effect of nano-TiO₂ polymorphs priming on seed germination, seedling growth and antioxidant enzyme activities viz. catalase (78-80%) and peroxidase (75-162%) of Kidney bean. The best concentration of nano-TiO₂ polymorph was 2.50 %.

Keywords: nano-TiO₂; anatase; rutile; kidney bean**The Carbon Cost of Clean: A Life Cycle Perspective on the Environmental Impact of Skincare Routines****Kajal Sorout***Department of Chemistry, Sanskriti University, Mathura, India.***Abstract**

This paper explores the often-overlooked carbon footprint of daily skincare routines through a life cycle assessment (LCA) framework. While clean beauty has become a symbol of conscious consumption, the environmental impact of its production, packaging, transportation, and disposal is rarely quantified in consumer conversations. From the raw material extraction of natural ingredients to the energy-intensive manufacturing processes and plastic-heavy packaging waste, every step contributes to greenhouse gas emissions. Through analysis of commonly used products like cleansers, toners, serums, and moisturizers, this paper reveals how even minimalist routines can carry hidden environmental costs. It examines emissions associated with various skincare ingredients, compares traditional vs. clean beauty supply chains, and evaluates the role of consumer behavior, brand practices, and greenwashing in perpetuating unsustainable cycles. The paper also provides practical recommendations for consumers and formulators to reduce carbon impact without compromising skin health. Ultimately, it urges a shift

from appearance-based marketing to transparency, circular design, and truly sustainable innovation in skincare.

Introduction

In recent years, clean beauty has emerged as a global trend, promoting products with natural ingredients, non-toxic formulations, and minimal environmental impact. However, the narrative surrounding clean beauty often overlooks the full carbon cost associated with product life cycles—from raw material extraction to end-of-life disposal.

Objectives

This paper aims to explore the total environmental impact of skincare routines, particularly clean beauty products, by examining each phase of a product's life cycle. It aims to bring transparency to consumer choices and recommend ways to minimize the carbon footprint of daily routines.

Methods

A qualitative life cycle assessment (LCA) approach was employed to analyze common skincare items such as cleansers, exfoliants, serums, and moisturizers. Emissions from sourcing, manufacturing, packaging, transportation, and waste disposal were estimated based on existing environmental reports, scientific literature, and industry databases.

Results

The study found that clean beauty products, despite their branding, often carry comparable or higher carbon costs due to the demand for rare botanical ingredients, excessive packaging, and international supply chains. Key findings include:

- Packaging (especially glass and virgin plastic) contributes up to 40% of total emissions.
- Transportation, particularly for imported exotic ingredients, significantly adds to carbon output.
- Water usage during production and daily use remains a hidden but impactful factor.

Conclusion

While clean beauty promotes ethical and eco-conscious consumption, the true environmental footprint of these routines is complex. Both consumers and manufacturers need to rethink priorities—emphasizing carbon transparency, local sourcing, minimalist routines, and refillable packaging. Redefining 'clean' to include low-emission processes can guide the beauty industry toward meaningful sustainability.

Recommendations

1. Encourage carbon labeling on skincare products.
2. Support brands using local ingredients and minimal packaging.
3. Educate consumers about overconsumption and lifecycle impact.
4. Promote refillable and recyclable packaging systems.

Allelopathic impact of aqueous leaf extract of Wild Himalayan Cherry (*Prunus cerasoides*) on seed germination and early growth on traditional agriculture crops of Garhwal Himalaya

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ABSTRACT

Allelopathy refers to the biochemical interactions between plants, particularly where one species inhibits the growth of another through the release of allelochemicals. In agroforestry systems, tree allelopathy can profoundly influence the growth and development of crops, primarily through the mechanisms by which these compounds affect soil and plant interactions. The investigation into the allelopathic effects of *Averrhoa carambola* and *Prunus cerasoides* on traditional agricultural crops highlights the significant impact of aqueous leaf extracts from these species on germination and growth of associated test crops. For the, the experiment was conducted at the Department of Forestry and

Natural Resources, HNB Garhwal University, investigated the allelopathic effects of *Prunus cerasoides* (wild cherry) aqueous leaf extracts on two traditional Himalayan crops: *Hordeum vulgare* (barley) and *Eleusine coracana* (finger millet). Dried leaf extracts were prepared at three concentrations i.e. 1g (1001.14 ppm), 3g (3003.42 ppm), and 5g (5005.71 ppm) and tested under Petri dish and blotting paper conditions with three replicates and a control. Results revealed that lower concentrations (1g) promoted germination and early growth, while higher concentrations (5g) significantly inhibited germination percentage, root length, and biomass. *H. vulgare* exhibited greater tolerance compared to *E. coracana*, with maximum germination (88.33%) under control and minimum germination (38.33%) in *E. coracana* at 5g concentration. Shoot length remained statistically non-significant across treatments. Duncan's post hoc test and ANOVA confirmed significant effects of treatments on germination percentage, root length, fresh weight, and dry weight. Correlation analysis showed germination was negatively correlated with species interaction ($r = -0.530$; $p < 0.01$) but positively correlated with fresh ($r = 0.442$) and dry weight ($r = 0.456$). Root length showed strong negative correlations with species and shoot length, while dry and fresh weights were positively interrelated ($r = 0.667$; $p < 0.01$). The findings indicate that *P. cerasoides* exhibits both promotive and inhibitory allelopathic effects depending on concentration, suggesting that high levels of leaf mulch or extract could suppress crop performance. These results highlight the need for species compatibility and dosage management when integrating allelopathic plants in agroforestry systems to optimize productivity and reduce negative interactions.

Keywords: *Agroforestry; Allelopathy; Eleusine coracana; Hordeum vulgare; germination and growth Prunus cerasoides*

Insecticidal Potential of *Metarhizium anisopliae* Isolates: Correlation of Volatile Secondary Metabolites with Bioefficacy against *Spodoptera litura*

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ABSTRACT

Sustainable pest management demands novel, eco-friendly strategies to reduce reliance on synthetic pesticides. Entomopathogenic fungi, particularly *Metarhizium anisopliae*, have emerged as promising biocontrol agents due to their diverse secondary metabolites with insecticidal potential. This study explored the biochemical basis of virulence in twelve *M. anisopliae* isolates by profiling their volatile organic compounds (VOCs) and correlating them with bioefficacy against *Spodoptera litura*. Volatile metabolites were characterized using gas chromatography–mass spectrometry (GC-MS/MS), while laboratory bioassays quantified larval mortality as a measure of pathogenicity. A key objective was to establish whether the diversity of volatile metabolites directly contributes to insecticidal performance, offering a metabolite-guided approach for strain selection. *M. anisopliae* UASR BC-Ma38 emerged as the most potent isolate, achieving 98.89 % larval mortality and producing 28 distinct VOCs, many associated with strong insecticidal activity. Conversely, ICAR-NBAIR-Ma14 showed the lowest virulence, with 45.56 % mortality and only 14 metabolites detected. A clear positive correlation between VOC abundance and bioefficacy highlights the critical role of volatile secondary metabolites in enhancing fungal pathogenicity. This work not only identifies UASR BC-Ma38 as a highly promising candidate for biocontrol programs but also demonstrates the novelty of linking metabolite diversity to insecticidal potential. By integrating chemical profiling with bioassays, the study provides a comprehensive framework for selecting superior fungal isolates, paving the way for the development of next-generation, metabolite-driven pest management strategies leveraging entomopathogenic fungi.

Keywords: *Metarhizium anisopliae; volatile organic compounds; GC-MS/MS; Spodoptera litura; biological control*

Thresholds of Salinity Tolerance in Amur Carp: Impact on Survival and Behavior**Nikki and Shikha Ahalavat***Department of Zoology and Aquaculture, CCSHAU, Hisar, India.***ABSTRACT**

A 60day study was conducted to evaluate the growth and survival of Amur carp (*Cyprinus carpio haematopterus* (Linnaeus, 1758)) in inland saline waters of Haryana, India. A total of 300 fingerlings (initial mean weight: 8.10 g) were randomly assigned to five salinity treatments—Control (0 ppt), T1 (3 ppt), T2 (6 ppt), T3 (9 ppt), and T4 (12 ppt) - each with three replicates, following an acclimatization phase. Throughout the experiment, no significant differences were observed in water pH, temperature and dissolved oxygen. However, increasing salinity led to significant elevations in ammonia, nitrite, TDS (total dissolved solids), and conductivity.

Survival was highest in the 3 ppt group, and declined progressively in the 6, 9, and 12 ppt groups. Notably, behavioural changes—such as reduced swimming activity and decreased appetite—were observed at 9 ppt and 12 ppt. Growth rates decreased significantly from control through T4 ($P \leq 0.05$), while feed conversion ratio (FCR) increased with salinity.

These findings indicate that Amur carp can sustain 100% survival up to approximately 5–6 ppt salinity, but survival diminishes at 9–12 ppt. Behavioural impairments and reduced appetite occur at salinities ≥ 9 ppt and longterm growth performance deteriorates with increasing salinity, accompanied by a worsening FCR.

Keywords: *Amur carp; behaviour; growth; salinity; survival*

Comparison of antibacterial properties of ZnO nanoparticles synthesized from aqueous root extract of *Rubia cordifolia***Poonam¹ and Ankit Yadav²**¹*Department of Zoology, CCSHAU, Hisar, India.*²*Department of Zoology, MDU, Rohtak, India.***ABSTRACT**

Nanoparticles (NPs) have drawn a lot of scientific attention in recent decades because of their distinctive physicochemical characteristics and wide range of uses in the food, cosmetics, and biomedical industries. Zinc oxide (ZnO) nanoparticles distinguish apart among these due to their huge band gap, high binding energy, low toxicity, and variable surface area, size, and shape. *Rubia cordifolia* root extract, a natural reducing and stabilizing agent, is used in this study's green production of ZnO nanoparticles. Biosynthesis of *Rubia cordifolia* aqueous Zinc oxide nanoparticles done according to the protocol modified from Naiel et al. 2022. FTIR, TEM, zeta potential analysis, and UV-visible spectroscopy were used to analyse the biosynthesized ZnO NPs, which ranged in size from 12.3 to 28 nm. Both Gram-positive (*Staphylococcus aureus*) and Gram-negative (*Pseudomonas aeruginosa* and *Klebsiella pneumoniae*) bacteria have been examined for antibacterial activity utilizing the agar well diffusion method. The greatest zone of inhibition was measured at 8 mm for *K. pneumoniae* and 6 mm for *P. aeruginosa* at 200 mg/ml. Five doses (25–200 mg/ml in 2 ml DMSO) were investigated. The control groups showed no signs of inhibition. At lower concentrations (5–20 mg/ml), PVA-ZnO nanocomposites demonstrated antibacterial action, whereas ZnO NPs enhanced by *Rubia cordifolia* needed larger doses (50–200 mg/ml) to achieve similar efficiency. This study also explores the structural and morphological characteristics of the synthesized nanoparticles and proposes potential mechanisms of bacterial inhibition, highlighting the interaction of ZnO NPs with bacterial cell walls that may lead to membrane disruption and cell death. Overall, green synthesis offers a sustainable, cost-effective, and efficient alternative to conventional nanoparticle fabrication methods, with promising antibacterial applications.

Keywords: *Green synthesis; Zinc oxide nanoparticles; Rubia cordifolia; Antibacterial activity; Nanotechnology*

Grain Amaranth: A climate smart nutri-rich potential crop, its present scenario and future market potential

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ABSTRACT

Grain amaranth (*Amaranthus* spp.) is one of the potential pseudocereal known for its unic protein (15%) and amino acids (5% Lysin) and mineral composition. Eating amaranth grains helps to reduce inflammation by slowing the body's production of Immunoglobulin E. Grain amaranth meal serves as a substitute for wheat, barley and rye in diverse recipes, facilitating those with gluten limitations alternative meals. Amaranth demonstrates a high tolerance for challenging factors such as drought, saline soils, and frost. Its cultivation in Gujarat has gained momentum as compared to other parts of the country. The area under this crop is increasing, particularly in Banaskantha and Kheda districts where this crop replaced wheat and potato because of water scarcity. In Gujarat, Palanpur APMC (Agricultural Produce Market Committee) market of Banaskantha district is one of the biggest markets for amaranth grain selling/purchasing, from where the grain is exported to other parts of the country. The area and consumer preference for grain amaranth is also increasing in Karnataka because of its nutritional qualities. Comparatively grain amaranth is one of the profitable crop as compared to other regular grown crops like finger millet and maize in Karnataka. In Europe, pseudo cereals are a specialized market with rising yearly requests. North America, Latin America, the Middle East, Europe, Africa and the Asia Pacific region are the grain amaranth's primary trade routes. The global amaranth market is anticipated to grow with a compound annual growth rate (CAGR) of 10.4% through the era. Meeting international quality standards opens the door to global trade, especially as the demand for nutritious, sustainable foods grows. Value-added products like amaranth oil (with its squalene content) and nutraceuticals from leaf extracts offer further market opportunities. Lacking awareness about health benefits among people and tiny seeds of amaranth has low yield potential and no mechanization is available in this crop restricts area expansion. Scope for crop improvement for higher test weight and mechanization for sowing and harvesting will help farmers for cultivation in future.

Keywords: *Grain amaranth; Nutritional profile; Uses; health benefits; Present scenario; Future Market; Potential; Production constraints and strategies*

Study of Soil Chemical Properties and Yield Parameters of Pigeonpea in Conventional method and Vedic method by using PGR and Jeevamrut

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ABSTRACT

The present investigation entitled was carried out at Department of Agricultural Botany, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola (M.S.) to study the effect of plant growth regulators and jeevamrut on soil chemical properties and yield parameters of pigeonpea. The experiment comprised of pigeonpea variety i.e. PKV (TARA) laid out in randomized block design with four replication, provided with eight

treatments of two growth regulators i.e. GA₃ and NAA at various concentrations i.e. 25, 50 and 75 ppm including jeevamrut and control. Spraying of growth regulators was done at flower initiation stage (stage 1) and pod initiation stage (stage 2) and soil application of jeevamrut was done at 30, 60, 90 and 120 DAS. Out of eight treatments seven treatments of two plant growth regulators with three concentrations were grown by adopting package of practices of conventional method of sowing and eighth treatment of soil application of jeevamrut was grown by adopting package of practices of Vedic method. Results indicated that in case of chemical properties of the experimental site, the foliar application of plant growth regulators and soil application of jeevamrut had no influence on soil pH, however pH value ranged from 7.82 - 7.83. Maximum soil EC (0.16 dSm⁻¹) was observed before the start of the experiment and minimum soil EC (0.13 dSm⁻¹) was observed after the completion of experiment. Maximum nitrogen and potassium content in soil was significantly recorded by the soil application of jeevamrut- @ 500 l ha⁻¹ followed by the foliar application of GA₃-75 ppm during second year. Whereas in case of phosphorus content of soil, GA₃-75 ppm and jeevamrut was at par with each other. Similarly, foliar application of GA₃-75 ppm recorded significantly more number of pods plant⁻¹, seeds pod⁻¹, highest 100 seed weight plant⁻¹ and highest seed yield followed by NAA -75 ppm and by soil application of jeevamrut- @ 500 l ha⁻¹. the highest GMR (Rs. 111263 ha⁻¹), NMR (Rs. 78325 ha⁻¹) and cost : benefit ratio (1:3.38) with treatment (T₄) foliar application of GA₃ at 75ppm followed by treatment (T₈), soil application of jeevamrut-@ 500 l ha⁻¹ (1: 3.20).

Key words : *Plant growth regulators; Jeevamrut; Soil Chemical Properties; Yield parameters and Pigeonpea*

One ha model – A profitable farming system for marginal and small farmers.

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ABSTRACT

Majority of Indian farmers are small and marginal whose land holdings are considered as uneconomic. In Rewa district of MP more than 73% of total farming community belongs to this category. Our country can not prosper agriculturally until these uneconomic holdings are considered as non viable . There is a need to undertake experiments on converting these uneconomic holdings into economic holdings so that the farmers can not only uplift the socio-economic conditions but also contribute to the nation's growth. The substantial increase in yield & income was observed over the traditional system of cropping. This increase in yield & income could be attributed to intensive use of land and diversification of cropping pattern. Where the farmers was finding it difficult to produce adequate food to feed his family with traditional system has now able to save Rs. 33,5452 per annum with all in all gross income of Rs. 63,0562.

Rooted In Resilience: Strategies For Sesame Survival Under Waterlogging Stress

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ABSTRACT

Sesame (*Sesamum indicum* L.) is a highly valued oilseed crop recognized for its drought tolerance and adaptability to marginal soils. However, it remains extremely vulnerable to waterlogging stress, especially during seedling and flowering stages. In states like Bihar—where sesame is cultivated during the summer and kharif seasons in low-lying, flood-prone areas—erratic rainfall and inadequate drainage infrastructure make waterlogging a recurring challenge. Even brief water stagnation (24–72 hours) can

severely affect sesame physiology, resulting in stunted growth, poor seed set, chlorosis, and reduced oil content. Waterlogging primarily disrupts root oxygen availability, impairs nutrient and water uptake, and causes oxidative stress due to the accumulation of reactive oxygen species (ROS). It reduces stomatal conductance, disturbs hormonal balance (notably ethylene and ABA), and damages cell membranes. Traditional sesame varieties grown in Bihar lack resilience to such abiotic stress. To combat this, a multi-dimensional adaptation strategy is crucial. Identifying and breeding waterlogging-tolerant genotypes—possessing traits like adventitious rooting, aerenchyma formation, and higher antioxidant enzyme activity—is key. Modern tools like marker-assisted selection (MAS) and transcriptomic profiling of stress-responsive genes (e.g., ERFs, MYBs, aquaporins) can accelerate the development of resilient varieties suited to Bihar's agro-ecology. Agronomic interventions such as raised-bed planting, ridge-furrow systems, improved surface drainage, and shifting sowing windows help avoid peak monsoon inundation. Bio-priming seeds with beneficial microbes (e.g., *Azospirillum*, *Trichoderma*, AMF) and foliar sprays of proline or salicylic acid mitigate waterlogging-induced damage. At the institutional level, improving drainage infrastructure, promoting intercropping, early flood warnings, and government support for resilient varieties are vital. Farmer awareness, capacity-building, and participatory breeding programs must be strengthened. In Bihar's context, ensuring sesame's resilience to waterlogging is both a scientific imperative and a socio-economic necessity to secure rural livelihoods, nutritional security, and sustainable oilseed production under changing climatic conditions.

Keywords: *Sesame; Waterlogging; Bihar; Adaptation; Mitigation*

Microbial Population and Soil Enzymes Influenced By Long Term Fertilization Under Vertisol

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EXTENDED SUMMARY

Purpose

Soybean and safflower are grown as major kharif and rabi crops, respectively in the region. Low soil fertility and inadequate manuring are the major causes of low yield of both the crops. Higher dose of chemical fertilizer and agricultural chemicals and insufficient use of organic manures leads to negative impact on fertility and productivity of soil. By and large, Indian soils showed either deficiency or inadequacy in cluster of major and micro-nutrients. Regular and prolonged exploitation of soil resources for crop cultivation without addition of fertilizers and in adequate supply of fertilizers create nutrient imbalance in soil. Long-term fertilizer experiments (LTFE) offer a better platform to visualize the status of micronutrients in soil under intensive cropping and their contribution to sustained production. Continuous crop cultivation along with insufficient and uneven fertilizer application reduces soil fertility, which poses a major threat to succeeding crops. But when organic and inorganic sources are mixed, the behaviour of soil moisture and other physical and chemical qualities that increase soil productivity are significantly and directly impacted.

Material And Methods

A field experiment was carried out during kharif and rabi seasons of the year 2021-2022. on the research farm of AICRP on LTFE, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani. The experimental soil is characterized by black color dominated by montmorillonite clay with high coefficient of expansion and shrinkage in summer which leads to deep cracking. Soil samples were collected at 0-15 cm depth from twelve treatment plots before sowing and at harvest of crop. Pre-sterilized polythene bags were used for the collection of soil samples for microbial properties and composite sample was prepared in the laboratory. The soil samples were kept in a refrigerator till isolation procedure was completed. The isolation of bacteria, fungi and actinomycetes were determined from experimental plot by using different media for specific group of microflora. Dehydrogenase enzyme activity in soil at

harvest was measured by reduction of 2, 3, 5-triphenyl tetrazolium chloride (TTC) to triphenyl formazan (TPF) using colorimetric procedure of Cassida et.al. (1964). The total phosphatase activity of acid and alkaline phosphatase at harvest in soil was determined as per method given by Tabatabai and Bremner (1969), p-nitrophenyl phosphate tetrahydrate (pH 6.5) solution was used for the assay of acid phosphatase while the same p-nitrophenyl phosphate tetrahydrate solution of pH 11.0 was used for estimation of alkaline phosphatase activity.

Results

The population of bacteria, actinomycetes and enzyme activities was found to be maximum in 100 % NPK + FYM @ 5 t ha⁻¹ than all other treatments of long term fertilization at harvest in soybean-safflower cropping sequence. Even as, fungal population was observed maximum in only FYM @ 10 t ha⁻¹ than the other treatments. Population of bacteria, fungi and actinomycetes were varied from 30.26 to 58.51 CFU × 10⁻⁷ g⁻¹ soil, 6.76 to 13.84 CFU × 10⁻³ g⁻¹ soil and 27.11 to 50.61 CFU × 10⁻⁴ g⁻¹ Soil, respectively. Dehydrogenase activity and acid and alkaline phosphatase activity significantly improved with the application of organic in combination with inorganic (100 % NPK + FYM @ 5 t ha⁻¹). Dehydrogenase activity of soil ranged from 41.40 to 64.12 µg TPF g⁻¹ soil 24 hr⁻¹. Acid phosphatase enzyme activity in soil ranged from 39.57 to 64.64 µg p-NP g⁻¹ soil hr⁻¹. Alkaline Phosphatase activity in soil varied from 100.41 to 146.80 µg p-NP g⁻¹ soil hr⁻¹.

Conclusion

The soil microbial properties like bacterial and actinomycetes population were recorded significantly maximum in 100 % NPK + FYM @ 5 t ha⁻¹ however, fungal population was recorded significantly maximum by application only FYM @ 10 t ha⁻¹. Whereas, enzyme activity viz; dehydrogenase, acid and alkaline phosphatase were significantly increased with use of organics (FYM) in conjunction with chemical fertilizer (100 % NPK + FYM).

Keywords: Long term fertilization; bacteria; fungi; actinomycetes and soil enzymes

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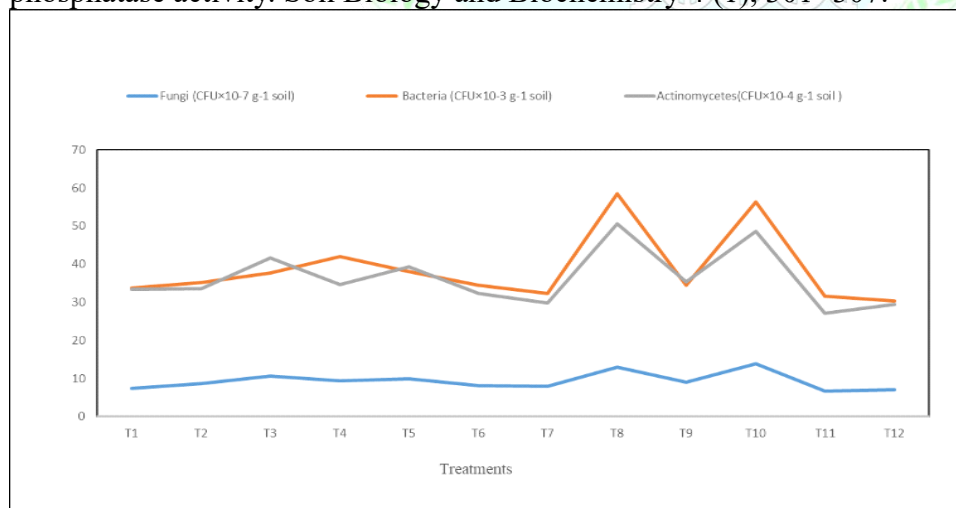


Fig 1: Long term effect of organic and inorganic fertilizers on soil bacterial (CFU × 10⁻⁷ g⁻¹ soil), fungal (CFU × 10⁻³ g⁻¹ soil) and actinomycetes (CFU × 10⁻⁴ g⁻¹ soil) population at harvest in soybean-safflower cropping sequence

Effect of Organic and Inorganic Fertilizers on Microbial Population and Soil Enzymes under Soybean –Safflower Cropping Sequence in Vertisols**Dhyaneshwari M. Zol, Bhagyaresha R. Gajbhiye and Ramprasad N. Khandare***Department of Soil Science, College of Agriculture, Vasant Rao Naik Marathwada Krishi Vidyapeeth, Parbhani, (M. S.), India.***ABSTRACT**

The present investigation entitled “Effect of Long term Fertilization on Biological Properties of Soil under Soybean –Safflower Cropping Sequence in Vertisols. ” A field experiment carried out during 2021-22 at Long Term Fertilizer Experiment Research Farm, Vasant Rao Naik Marathwada Krishi Vidyapeeth, Parbhani. The experiment was carried out in Randomized Block Design (RBD) with 12 treatments replicated four times.

Population of bacteria, fungi and actinomycetes were varies from 30.26 to 58.51 CFU $\times 10^{-7}$ g⁻¹ soil, 6.76 to 13.84 CFU $\times 10^{-3}$ g⁻¹ soil and 27.11 to 50.61 CFU $\times 10^{-4}$ g⁻¹ Soil, respectively, at harvesting in soybean-safflower cropping sequence. Dehydrogenase activity and acid and alkaline phosphatase activity significantly improved with the application of organic in combination with inorganic. dehydrogenase activity of soil ranged from 41.40 to 64.12 μ g TPF g⁻¹ soil 24 hr⁻¹. Acid phosphatase enzyme activity in soil ranged from 39.57 to 64.64 μ g p-NP g⁻¹ soil hr⁻¹. Alkaline Phosphatase activity in soil varied from 100.41 to 146.80 μ g p-NP g⁻¹ soil hr⁻¹.

Keywords: Long term fertilization; bacteria; fungi; actinomycetes and soil enzymes

Organic Farming And Behavioral Change In Diverse Farming Systems**Sowmya, T.M., Mallika Meti, Sidaram, Y and Rajashekar Basanayak***Department of Agricultural Extension Education, Agricultural Research Station, Kawadimatti, University of Agricultural Sciences, Raichur, Karnataka, India.***ABSTRACT****Purpose**

Addressing climate change requires transformative shifts in agricultural practices, particularly at the grassroots level. Among such sustainable alternatives, organic farming emerges as a climate-resilient and environmentally sustainable option that improves soil health, reduces reliance on agrochemicals, and enhances carbon sequestration. This study investigates behavioral change among farmers transitioning to organic farming, focusing on their environmental, economic, and health-related perceptions. A comparative analysis between farmers in irrigated and rainfed ecosystems was conducted to understand differential responses, evaluate attitudinal trends, and assess the extent of behavioral adaptation toward organic practices.

Materials and Methods

The research was carried out with a total of 180 farmers, evenly divided between irrigated (n=90) and rainfed (n=90) regions. A structured interview schedule was developed to capture farmers' responses across three thematic dimensions: environmental, economic, and health aspects of organic farming. Each dimension was rated and categorized as ‘less favourable,’ ‘favourable,’ or ‘more favourable’ based on farmers’ perceptions. Attitudinal scores were calculated and statistically analyzed to derive mean, standard deviation, and percentage distributions. The collected data were also pooled to provide an overarching view of behavioral trends and variations across ecosystems.

Results

The findings revealed distinct attitudinal differences between the two groups. Rainfed farmers exhibited a higher level of environmental favorability (Mean = 26.83) compared to irrigated farmers (Mean = 23.98). This could be attributed to their increased vulnerability to climatic variability, making them

more receptive to sustainable practices. In terms of economic perception, farmers displayed a relatively balanced outlook across both regions, with 41.67% of respondents expressing favourable and 40.56% expressing highly favourable attitudes toward organic farming's economic viability. Notably, health-related awareness was stronger among rainfed farmers, with 54.44% falling into the more favourable category, indicating greater sensitivity to health impacts of chemical inputs. When analyzing the overall attitude toward organic farming, 40.56% of all farmers exhibited a favourable disposition, while 40.00% showed a highly favourable outlook. The mean overall attitudinal score was slightly higher among rainfed farmers (Mean = 72.53, SD = 4.84) than among irrigated farmers (Mean = 69.85, SD = 5.79), suggesting that rainfed farmers are more inclined toward embracing organic farming as a sustainable and climate-friendly solution.

Conclusions

The study underscores a significant behavioral shift among farmers, particularly in rainfed regions, towards adopting organic farming practices. This positive transition highlights the potential of behavioral change strategies to act as catalysts for climate action and sustainable development in agriculture. Increased environmental consciousness and health awareness among rainfed farmers reflect their responsiveness to ecosystem challenges and resource limitations. The findings advocate for the formulation of region-specific awareness programs, policy incentives, and institutional support mechanisms to further accelerate the transition to organic farming. Promoting farmer-led climate resilience through behavioral change can play a key role in achieving long-term sustainability goals and strengthening grassroots-level climate activism.

Keywords: *Behavioral change; Organic farming; Climate action; Sustainable agriculture; Farmer perception; Rainfed and irrigated ecosystems*

Effect of Climate change on Horticultural crops

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ABSTRACT

The growth and productivity of plants are significantly influenced by the climate. The phrase "climate change" is frequently used to describe changes in the climate brought about by human activity. The term "greenhouse effect" refers to the observed and predicted warming of the earth caused by an increase in the concentration of greenhouse gases in the atmosphere, such as carbon dioxide, nitrous oxide, ozone, and methane. These gases may have an impact on temperature, water demand, and biotic and abiotic stresses, which are mostly caused by the burning of fossil fuels and deforestation. It directly affects horticulture and agriculture. Low horticulture crop yield is a result of climate change. Both natural and human systems have been significantly impacted by recent climate change. There are several independently generated datasets for the worldwide averaged combined land and ocean surface temperature data, which, when calculated using a linear trend, show a warming of 0.85°C (0.65 to 1.06°C) between 1880 and 2012. According to the single longest dataset available, the overall increase between the average of the 1850–1900 period and the 2003–2012 period is 0.78°C (0.72 to 0.85°C). Given these issues, horticulturists will need to be involved in the climate change scenario, and appropriate plans for preserving horticulture must be envisioned. The best approach is to implement conservation agriculture, which uses renewable energy, conserves forests and water, reforests, etc. to maintain productivity. Other ways to reduce the impact of climate change include modifying current horticultural practices and increasing the use of greenhouse technology. The primary strategies to address these challenges will be the adoption of high-tech horticulture and prudent land use resource

management, as well as the development of new cultivars of horticultural crops that are tolerant of high temperatures, resistant to pests and diseases, short-lived, and produce good yield under stress conditions.

Impact of altitude and trampling intensity on Soil physico-chemical properties in North-Western Himalaya

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ABSTRACT

Research in forest science, biomes, and ecotourism management is increasingly focusing on the interactions between forest ecosystems and ecotourism activities. The aim of the present study, conducted between the years of 2021 and 2022, was to examine the influence of altitude and trampling intensity on soil physico-chemical properties along the tourist trail of Hatu in Shimla district of Himachal Pradesh. We conducted a comparison of soil properties, across three different elevations and four varying trampling intensities including a control. This study focused on areas with distinct levels of tourist disturbance as well as a control area that remained undisturbed (no trampling). The study area was categorized based on three elevations and four trampling intensities, along with one undisturbed area: E₁ at 2700 m, E₂ at 2900 m, and E₃ at 3100 m; trampling intensities included: very high trampling (90%) at 0-10 m, high trampling (70%) at 10-20 m, moderate trampling (50%) at 20-30 m, and low trampling (30%) at 30-40 m, in addition to the undisturbed zone (control). Results revealed that the analysis of correlations identified a significant negative correlation between soil electrical conductivity (EC) and both trampling intensities ($r = -0.69$, $p < 0.05$) and altitudes ($r = -0.63$, $p \leq 0.05$). With respect to altitude, soil N and K displayed non-significant negative correlations ($r = -0.28$, $p < 0.31$ and $r = -0.32$, $p < 0.24$, respectively), indicating a tendency to decrease with increasing altitude. Conversely, soil P exhibited a significant negative correlation with altitude ($r = -0.57$, $p < 0.03$). Consequently, the current trampling intensities are having a considerable adverse effect on the ecological environment of the Hatu religious trail.

Keywords: *electrical conductivity; correlations; elevation; trampling intensity; soil properties*

Assessing Sustainable Event Practices and the Challenges of Implementation Among Event Planners

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ABSTRACT

Sustainable event management has become a critical focus in the events industry due to increasing concerns about environmental degradation, social equity, and economic viability. With heightened awareness of climate change, resource consumption, and waste generation, event planners are now expected to balance event success with responsible and sustainable practices. Integrating sustainability into event planning is no longer a choice but a necessity for the long-term growth and relevance of the industry. This study aims to investigate current sustainable practices employed in event planning and

execution, identify the challenges faced by professionals in adopting these practices, explore the motivations behind sustainability efforts, and suggest strategies to enhance their adoption in the future. The research will utilize a structured questionnaire divided into five sections: respondent profile, key motivators, level of awareness and practice adoption, barriers to implementation, and recommendations for improvement. The outcomes of this study are anticipated to offer practical insights and guidance for event professionals, organizations, and stakeholders, supporting a more sustainable and responsible event management landscape.

Keywords: *Sustainable event management; Event industry practices; Environmental responsibility; Barriers and motivators; Event sustainability strategies*

Spatial Variability of DTPA-extractable Micronutrients across Soil Orders and Land Use Systems in Punjab, North-western India

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ABSTRACT

Micronutrient deficiencies, particularly of zinc (Zn), copper (Cu), iron (Fe), and manganese (Mn), have emerged as critical constraints affecting soil productivity and the long-term sustainability of agricultural systems. As agriculture becomes more intensive and diversified, these deficiencies are becoming increasingly widespread across various land use systems (LUSs). This study investigated the spatial variability of DTPA-extractable micronutrients (Zn, Cu, Fe, and Mn) across soil profiles in different LUSs—agriculture, horticulture, and forestry—within three major soil orders (Entisols, Inceptisols, and Aridisols) of Punjab, North-western India. Comprehensive soil sampling and analysis were carried out to examine the relationships between micronutrient availability, land use practices, and soil physico-chemical properties. The distribution of micronutrients varied significantly among soil orders, generally following the trend: Entisols > Inceptisols > Aridisols. Among land use systems, agricultural soils exhibited higher levels of Fe and Mn, while horticultural soils were higher in Zn and Cu. Regardless of soil order or land use, micronutrient concentrations declined with increasing soil depth. The variability in micronutrient availability was strongly influenced by land use practices and associated changes in soil properties. Correlation analysis indicated that micronutrients were positively associated with soil organic carbon and negatively correlated with pH, electrical conductivity, and calcium carbonate content. The findings underscore the need for land-use-specific and soil-order-based nutrient management strategies to address micronutrient deficiencies and promote sustainable soil fertility and crop productivity in the region.

Butterfly Community Composition in the Rajgir Wildlife Sanctuary, Bihar, Eastern India

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ABSTRACT

Butterflies serve as reliable indicators of ecosystem health, making them ideal for assessing habitat diversity across changing tropical landscapes. The Rajgir Hills, located within the eastern Indo-Gangetic plains, represent a distinct biogeographic enclave with ecological and cultural significance. This landscape is undergoing rapid ecological transformation, influenced by climatic variability and the

spread of invasive species. Despite its ecological potential, the butterfly fauna of Rajgir Wildlife Sanctuary (WLS) remains understudied.

We studied butterfly diversity and community composition across four major habitat types, Mixed Sal Forests, Ecotonal Bamboo Forests, Teak Plantations, and Open Scrublands using butterflies as bioindicators of habitat quality and ecological integrity. We recorded 94 butterfly species over a year-long survey from January to December 2023, sampling on 150 fixed transects revealing high species turnover within a compact spatial range in Rajgir WLS.

Alpha diversity indices, rank-abundance curves, NMDS ordination, and SIMPER analysis collectively indicated that habitat heterogeneity strongly influences butterfly assemblages. Mixed Sal Forests supported the highest species richness, likely due to their canopy complexity and diverse floral resources. Ecotonal Bamboo Forests promoted community evenness by supporting both habitat generalists and specialists, highlighting their role in ecological connectivity. Teak Plantations, despite structural simplification, supported shade-adapted taxa and offer restoration potential through native understorey enrichment. Open Scrublands and Grasslands, often undervalued, supported open areas preferring and disturbance-adapted species and may become increasingly important under shifting climate regimes.

The findings emphasize the importance of conserving habitat patches rather than focusing solely on butterflies which serve as reliable indicators of ecosystem health, making them ideal for assessing habitat diversity across heterogeneous tropical landscapes. Seasonally structured butterfly data offer critical insights into ecosystem functioning and human disturbances. This work contributes to baseline knowledge and essential information for long-term biodiversity monitoring in Rajgir WLS and within the broader context of the Indo-Gangetic plains.

Keywords: *Alpha Diversity; Bioindicators; Butterfly Diversity; Climate Variability; Community Composition; Eastern Indo-Gangetic Plains; Habitat Heterogeneity; Invasive Flora; Rajgir Wildlife Sanctuary; Tropical Forest Ecosystems*

Patterns in Space: Distribution of Butterflies in western Himalaya

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ABSTRACT

Elevational gradients provide a natural framework for understanding biodiversity responses to changing climatic and ecological conditions. In mountainous ecosystems like the Indian Himalayas, species composition and richness vary predictably with elevation, influenced by complex interactions between temperature, moisture, habitat structure, and isolation. Butterflies, owing to their sensitivity to environmental fluctuations and habitat specificity, serve as excellent indicators for studying these elevational biodiversity trends.

Our study reveals a distinct mid-elevation peak in butterfly species richness across sampled Himalayan transects. This pattern is strongly consistent with the water-energy hypothesis, which posits that species diversity is highest in zones where ambient energy (temperature and solar input) and water availability are optimally balanced. Mid-elevations provide moderate temperatures, stable humidity, and structurally diverse vegetation—conditions ideal for sustaining a wide range of butterfly species, including both habitat generalists and specialists.

In contrast, lower elevations, though energy-rich, often experience higher anthropogenic pressure, habitat degradation, and temperature extremes, resulting in lower diversity. High-elevation zones are colder, resource-limited, and host fewer but highly specialized butterfly taxa adapted to narrow climatic niches. These conditions limit overall richness but support unique alpine assemblages.

Our findings align with previous studies on other taxa from the Indian Himalayas, which also document a mid-domain richness peak. The observed pattern underscores the ecological value of mid-elevation belts, which serve as biodiversity hotspots and potential refugia in the face of climate change. As temperatures rise, upslope shifts in butterfly distributions are likely, increasing competition in already constrained high-elevation zones.

Understanding how butterfly richness responds to altitudinal and climatic gradients is essential for developing conservation strategies that integrate elevational diversity patterns. Protecting mid- and upper-elevation habitats will be key to maintaining ecological resilience and ensuring the persistence of montane butterfly communities under changing climatic regimes.

Keywords: *Altitudinal gradient; Biodiversity; Species richness; Water-energy hypothesis; Conservation*

Edible Aquatic Plants: Future Food Options

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ABSTRACT

The world is witnessing the changing eating habits among population with the introduction of newer food innovations in terms of products, processed and technologies. Still, food and nutritional security is one of the major concern area of whole globe. The condition of food and nutritional security is comparatively worse in developing countries than developed countries. Here, it is also important to note that developing countries have more natural resources as food options which could be better utilized to solve the issue of food and nutritional security. Recent studies have proved that edible aquatic plants like water cress, taro, water spinach, lotus, water lily, water chestnuts etc. could be better utilized as newer food options. These aquatic plants are not only rich in both major and minor food nutrients but also there is no harm in their cultivation. These are naturally growing food options, does not require chemical fertilizers for the plants so more safe to consume and grow. This paper is based on the findings of the one of the research project. The main objective of this paper is to draw the benefits of edible aquatic plants and how it can be further use in value addition. The research findings shows that edible aquatic plants like water cress, taro, water spinach, lotus, water chestnuts are also food in crisis and better utilized during time of flood and starvation. The leaves, roots, tubers and most commonly used parts of these aquatic plants and already developed into value added products like breads, soup sticks, biscuits, nuggets etc. Keeping in mind the nutritional security scenario, it is much needed to explore this newer area of food and nutritional security.

Keywords: *Aquatic plants; Foods; Nutrition Security; water lily; water chestnut*

Residue-Free Production with Organic Farming

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ABSTRACT

A sustainable agricultural method, organic farming aims to produce food free of pesticides, synthetic chemicals, and genetically modified organisms (GMOs). This method guarantees residue-free food production while fostering biodiversity, soil health, and environmental sustainability. Crop rotation, composting, natural pest control, and the use of organic inputs like manure and biological controls are the main tenets of organic farming. By storing carbon in soils, these methods not only improve biodiversity and soil fertility but also help slow down global warming. In organic farming, strict adherence to organic standards and certification procedures results in residue-free produce. Through

organic certification, producers are guaranteed to adhere to stringent guidelines pertaining to techniques, inputs, and traceability across the entire production chain. Concerns regarding chemical residues in food and their possible health effects have led consumers to favor organic products more and more. Because organic farming produces goods devoid of artificial fertilizers, pesticides, and herbicides, it fosters openness and consumer trust. Due to rising consumer knowledge and the need for more ecologically friendly and healthful food options, the global market for organic products is still developing. Farmers can increase their farm profitability, get access to premium markets, and support sustainable agriculture by practicing organic farming. But there are still a lot of obstacles to overcome, such the expense of certification, restrictions on market access, and competition from traditional agriculture. In order to overcome these obstacles and improve the scalability and effectiveness of residue-free agriculture, future organic farming research and development is essential. Organic farming will continue to expand globally thanks to advancements in sustainable agriculture techniques, soil health management, and organic pest control. All things considered, producing food without residue through organic farming holds promise for improving human health, environmental stewardship, and agricultural sustainability. Organic farming relies on natural resources and processes rather than artificial inputs like fertilizers and pesticides. Despite the use of some synthetic inputs during growth, residue-free farming aims to reduce or completely eradicate hazardous chemical residues in the finished product.

Keywords: *Sustainable agriculture; Organic farming; profitability; Residue free agriculture; hazardous chemicals*

Micropropagation of *Butea monosperma* (palash)

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ABSTRACT

Micropropagation of *Butea monosperma*, commonly known as Flame of the forest, is a crucial technique for its rapid and large-scale multiplication. This tree species holds significant medicinal, ecological, and economic importance. However, natural propagation through seeds is limited due to poor seed viability and germination rates. This study explores the micropropagation of *Butea monosperma* using tissue culture techniques. Nodal explants and shoot tip cultures were inoculated on Murashige and Skoog (MS) medium supplemented with varying concentrations of cytokinin (BAP, KINETIN) and auxins (IAA, IBA). Optimal shoot induction and multiplication were observed in MS medium fortified with 2.0 mg/L BAP and 0.5 mg/L NAA. Rooting was successfully achieved with half-strength MS medium supplemented with 1.0 mg/l IBA. Hardened plantlets were acclimatized in green house conditions before field transfer.

Micropropagation of *butea monosperma* offers a viable alternative for mass propagation, conservation, and sustainable utilization of this valuable species. This protocol can aid in reforestation programs, pharmaceutical applications and genetic conservation efforts.

Keywords: *micropropagation; Butea monosperma; MS medium; reforestation; genetic conservation*

Avian Responses to Climate Variability: Early Warnings from a Changing Ecosystem in Rajgir Wildlife Sanctuary, Bihar, India**Rakesh Kumar¹ and Manish Bhardwaj^{1,2}**¹*P.G. Department of Zoology, Magadh University, Bodh Gaya, Bihar, India.*²*Department of Zoology, S.N. Sinha College, Warisaliganj, Nawada, Bihar, India.***ABSTRACT**

The Rajgir Hills, nestled within the Eastern Indo-Gangetic plains of Bihar, constitute a vital ecological corridor connecting the Gangetic basin with the Chotanagpur Plateau. This study investigates how climate variability is subtly yet profoundly influencing avian community patterns in the Rajgir Wildlife Sanctuary (RWS). Over the course of a year-long survey from January to December 2023, systematic sampling across 94 fixed transects revealed a high degree of species turnover, even within a relatively compact spatial extent—suggesting notable shifts in bird assemblages potentially driven by changing climatic conditions.

Through transect surveys across varied habitats, ranging from dry deciduous forests and scrublands to rocky hill slopes and riparian patches—we documented more than 120 bird species. A closer look revealed telling changes in the presence, abundance, and seasonal behaviour of key species, especially insectivores and altitudinal migrants like the Tickell's Leaf Warbler (*Phylloscopus affinis*), Indian Paradise Flycatcher (*Terpsiphone paradisi*), and Verditer Flycatcher (*Eumyias thalassinus*). These birds showed a marked decline during years of erratic monsoon and prolonged heatwaves.

The year 2023, with rainfall nearly 29% below average, witnessed a noticeable dip in ground-nesting and forest-dependent birds. On the other hand, urban-resilient species such as the Common Myna (*Acridotheres tristis*) and House Crow (*Corvus splendens*) held their ground or even increased, pointing to a worrying trend of ecological homogenisation.

Seasonal shifts in the flowering and fruiting cycles of native trees like *Ficus* and *Terminalia* further affected frugivores, while altered wetland conditions saw fewer waterbirds. The emerging pattern is clear: birds are serving as early-warning indicators of ecosystem stress. If such climate anomalies persist, the sanctuary could face a silent erosion of both species richness and ecological roles. The need of the hour is long-term monitoring and community-driven habitat stewardship to safeguard the rich birdlife of this ancient and culturally significant landscape.

Keywords: *Altitudinal migrants; Bioindicators; Bird diversity; Climate variability; Ecological homogenisation; Rajgir Wildlife Sanctuary*

Space Applications: Remote Sensing and GIS in Climate Change Impacts and Solutions**Rahul Khudia***Guru Jambheshwar University of science and technology, India.***ABSTRACT**

Climate change poses one of the most pressing global challenges, with far-reaching impacts on ecosystems, weather patterns, sea levels, and human livelihoods. The use of space-based technologies, particularly Remote Sensing and Geographic Information Systems (GIS), has revolutionized the way scientists monitor, assess, and respond to these changes. Remote sensing provides continuous, synoptic, and multi-spectral data from satellite and airborne platforms, enabling the detection of shifts in land use, vegetation cover, glacial retreat, sea-level rise, and atmospheric changes with high temporal and spatial resolution. GIS complements remote sensing by allowing the integration, analysis, and visualization of spatial and temporal data to assess vulnerability, model climate scenarios, and support decision-making.

Together, these tools facilitate the monitoring of greenhouse gas emissions, tracking of extreme weather events, identification of climate-sensitive zones, and implementation of adaptive strategies. Applications include precision agriculture, disaster risk reduction, urban planning, forest and water resource management, and early warning systems. As climate change continues to accelerate, the synergy between remote sensing and GIS offers robust solutions for climate impact assessment and mitigation planning, supporting evidence-based policies and sustainable development goals. Future advancements in satellite technology, data analytics, and AI integration will further enhance the role of space applications in addressing the global climate crisis.

Evaluation Of Bio-Pesticides Against Sucking Pests Of Potato

Shikha Sharma, Sandhya Bakode, Karuna Meshram and R.C. Sharma

AICRP on Potato, Z. A. R. S., Chandangaon, Chhindwara, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, Madhya Pradesh, India.

ABSTRACT

Potato (*Solanum tuberosum* L.) belongs to family Solanaceae is one of the most important vegetable tuber crop and it ranks at third position in production after rice and wheat in the world as well as in India. Potato crop are prone to attacked by more than 80 insects and nematode pests in the field and in store which are one of the important limiting factor in raising productivity and production of potato in India. The sucking pests viz., aphids, hoppers, whiteflies and thrips are considered as a major group because of their role as the vectors of viral diseases. The field experiment was conducted at AICRP on Potao, Zonal Agricultural Research Station, Chhindwara. Among all the treatment T₆ i.e Imidacloprid 17.8SL spray (0.4 ml/l) recoded maximum reduction of aphid (65.66%), whitefly (67.23%), Thrips (69.90%) and Hopper (65.10%) with highest yield of 32.66t/ha followed by treatment T₅ i.e. Neemastra spray (20g/l) with aphid (53.98%), whitefly (56.66%), Thrips (51.92%) and Hopper (46.22%) reduction respectively with yield of 26.21 t/ha. Whereas, Minimum reduction recoded in treatment T₁ i.e. Neem soap spray (7g/l) with aphid (45.86%), whitefly (48.17%), Thrips (46.64%) and Hopper (37.67%) respectively with yield of 26.21 t/ha as compare to control 20.23 t/ha.

Keywords: *sucking pest; Management; mortality; Yield loss*

Surveillance of important potato diseases in the Satpura region (pest capture plots)

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AICRP on Potato, Z. A. R. S., Chandangaon, Chhindwara, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, Madhya Pradesh, India.

ABSTRACT

Potato (*Solanum tuberosum* L.) belongs to family Solanaceae is one of the most important vegetable tuber crop and it ranks at third position in production after rice and wheat in the world as well as in India. Potato crop are prone to attacked by number of diseases and pests in the field and in store which are one of the important limiting factor in raising productivity and production of potato in India. There was no incidence of late blight disease in all tested varieties, Minimum percent incidence of early blight (7.02 %), Phoma (1.2%), Severe mosaic (0 %), mild mosaic (0.98%) and leaf roll (0.93%) in Kufri Chipsona-1 followed by K. Lavkar with percent incidence of early blight (7.23%), Phoma (2.14%), Severe mosaic (2.01 %) mild mosaic (1.02 %) and leaf roll (1.43%). However, highest incidence of early blight (13.86%), Phoma (3.96 %), Severe mosaic (2.27%) mild mosaic (1.73%) and leaf roll (1.83%) was recorded in K. Pukhraj among all tested five varieties. However there were no incidence of any soil and tuber born diseases viz., common scab, black scurf and brown rot at the time of harvest.

Keywords: *Survillance; Potato diseases; Disease intensity*

Long-Term Performance Evaluation Of Pavements Incorporating Cement Stabilized Layer
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ABSTRACT

Cement-stabilized layers have emerged as a cost-effective and durable solution for enhancing pavement strength and service life. This study evaluates the long-term performance of flexible pavements incorporating cement-stabilized layers under real traffic and environmental conditions. Field data from multiple test sections, combined with laboratory tests on core samples, were analyzed to assess structural integrity, rutting resistance, cracking patterns, and moisture susceptibility over a service period of 10–15 years. The findings reveal that cement-stabilized layers significantly improve load-bearing capacity, reduce maintenance costs, and extend pavement life by 30–40% compared to conventional granular bases. Recommendations for design optimization and performance prediction using mechanistic-empirical models are presented.

Keywords: *Cement stabilization; pavement performance; durability; mechanistic-empirical design; fatigue cracking*

Smart Construction Techniques for Maximizing Efficiency and Structural Integrity in Rigid Pavements

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ABSTRACT

Rigid pavements, primarily composed of concrete slabs, offer high strength and durability, making them ideal for high-traffic areas and long-life infrastructure projects. However, traditional construction methods often involve labor-intensive, time-consuming, and quality-sensitive processes. This paper explores various innovative construction techniques that aim to enhance the efficiency, speed, and overall quality of rigid pavement installation. Methods such as slip-form paving, precast concrete panels, fiber-reinforced concrete, advanced curing technologies, and automation in reinforcement placement are critically analyzed. Comparative studies and recent case applications demonstrate how these techniques contribute to reducing construction time, improving surface durability, minimizing human error, and increasing cost-efficiency. The paper concludes by identifying best practices and future directions for the widespread adoption of these technologies in both urban and highway infrastructure.

Precision Farming Technologies for Enhancing Horticultural Crop Productivity

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ABSTRACT

The increasing demand for high-quality horticultural produce, coupled with constraints in land, water and labor, has necessitated the adoption of precision farming technologies in modern horticulture. Precision farming involves site-specific crop management through the integration of advanced tools such as GPS, GIS, remote sensing, variable rate technology (VRT), sensor-based irrigation and unmanned aerial vehicles (UAVs). These technologies enable real-time monitoring of crop health, soil moisture, nutrient status and pest or disease outbreaks, thereby allowing timely and accurate

interventions. In horticultural crops, precision farming improves input-use efficiency, enhances productivity, reduces environmental impact and ensures uniform crop quality. This paper highlights successful case studies where precision tools have been employed in high-value crops such as tomato, grapes, banana and pomegranate, resulting in significant yield gains and cost savings. The challenges related to adoption, including high initial investment and lack of technical expertise among farmers are also discussed. The abstract concludes by emphasizing the need for capacity- building, customized solutions for smallholders, and supportive policies to mainstream precision farming in horticulture for sustainable and profitable crop production.

Efficacy of Botanicals and Plant Extracts Against Major Fungal Pathogens

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ABSTRACT

The growing concern over chemical pesticide residues, environmental pollution and fungicide resistance has led to increased interest in eco-friendly alternatives for managing plant diseases. Botanicals and plant extracts offer a sustainable and cost-effective approach to controlling fungal pathogens, particularly in horticultural and field crops. This study evaluates the antifungal efficacy of selected botanicals—namely neem (*Azadirachta indica*), garlic (*Allium sativum*), ginger (*Zingiber officinale*), tulsi (*Ocimum sanctum*) and turmeric (*Curcuma longa*)-against major fungal pathogens such as *Rhizoctonia solani*, *Fusarium oxysporum*, *Alternaria alternata* and *Colletotrichum* spp. In vitro assays, including poisoned food technique and spore germination inhibition tests, revealed that garlic and neem extracts showed the highest inhibitory effects on mycelial growth and sporulation. Field trials conducted on mungbean and tomato demonstrated significant reductions in disease incidence and improvement in plant vigor following foliar application of botanical formulations. The presence of bioactive compounds such as allicin, azadirachtin, curcumin and eugenol are attributed to their antimicrobial properties.

Sowing Change: Cultural And Social Shifts Through Organic Farming In Southern India

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Purpose

This case study aims to explore how the transition from conventional to organic farming can serve as a vehicle for social change, cultural transition, and climate resilience in rural India. It focuses on the individual journey of a farmer who leveraged institutional support, traditional practices, and market innovation to transform his livelihood while contributing to sustainable agriculture.

Material and Methods

The study is based on the experience of Mr. Shankaregowda, a 43-year-old farmer from Devagalli village in Mysore district, Karnataka. Over a period of nine years, he shifted five acres of land from conventional to organic farming. Data were collected through personal interviews, field observations,

and secondary inputs from JSS-KVK, Suttur. The methodological approach included qualitative analysis of the transition process—covering planning, production, pest management, and marketing strategies—alongside the socio-economic and cultural impacts of this shift.

Results

The transition resulted in a diversified cropping system integrating perennial (coconut, mango, sapota) and short-duration crops (leafy vegetables, tomato, Lady finger). Key interventions included use of drip irrigation, organic nutrient cycles (FYM, Vermicompost, Jeevamrutha), and neem-based pest control. The farmer adopted direct-to-consumer marketing, improving income stability and price control. The transition also enabled regular employment, reduced dependency on external inputs, enhanced local resource utilization, and promoted cultural practices aligned with ecological sustainability.

Conclusion

This case exemplifies how grassroots-level innovation and institutional collaboration can drive not just agronomic transformation, but also deeper social and cultural change. The organic farming transition contributed to climate-resilient agriculture, economic empowerment, and a shift in cultural mindset—from input-dependency to self-reliance and ecological stewardship. Such micro-level insights are critical for informing macro-level climate action strategies and rural development policies.

Keywords: *Social change; Organic farming; Cultural transition; Farmer innovation; Climate resilience; Karnataka; India*

Effect of Balanced Ration Feeding on Milk Yield and Quality in Dairy Cattle

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ABSTRACT

Balanced ration feeding plays a critical role in optimizing milk production and maintaining the health and reproductive efficiency of dairy animals. This study was conducted to evaluate the impact of balanced ration formulations on milk yield and compositional quality in crossbred dairy cows. A total of 30 lactating cows were divided into two groups: one receiving traditional farmer-fed diets (control) and the other fed a scientifically formulated balanced ration based on NRC guidelines (treatment group). Parameters such as daily milk yield, fat percentage, SNF (solids-not-fat) and protein content were monitored over a 90-day period. The results showed a significant increase ($P < 0.05$) in average daily milk yield in the treatment group, with improvements ranging from 15% to 20% over the control. Additionally, milk fat and protein percentages were markedly higher in cows receiving the balanced ration, indicating enhanced nutrient utilization and rumen efficiency. The feeding strategy also improved overall body condition scores and reduced incidence of metabolic disorders. The importance of ration balancing using locally available feed resources and mineral mixtures for boosting dairy productivity and milk quality. Adoption of balanced feeding practices can lead to improved economic returns for farmers while ensuring animal welfare and sustainability. Capacity building and extension support are essential to scale this intervention among small and medium dairy farmers.

Efficacy of Botanicals and Plant Extracts Against Major Fungal Pathogens

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ABSTRACT

Soil-borne pathogens such as *Rhizoctonia solani*, *Fusarium oxysporum*, *Sclerotium rolfsii* and *Pythium aphanidermatum* pose serious threats to a wide range of crops by causing root rot, wilt and damping-off diseases. The increasing resistance to chemical fungicides and the need for sustainable agriculture have led to greater emphasis on biological control strategies. Among microbial biocontrol agents, *Trichoderma* spp. has emerged as one of the most effective and extensively studied fungi for the management of soil-borne pathogens. The antagonistic potential of different *Trichoderma* isolates, including *T. harzianum*, *T. viride* and

T. asperellum, through in vitro and in vivo experiments. Dual culture assays revealed strong mycelial inhibition of target pathogens, attributed to mechanisms such as mycoparasitism, antibiosis and competition for nutrients. Greenhouse trials showed that seed treatment and soil application of *Trichoderma* formulations significantly reduced disease incidence in crops such as tomato, chickpea, and mungbean, while enhancing root growth and plant vigor. The production of lytic enzymes (e.g., chitinase, glucanase) and secondary metabolites further contributes to the biocontrol efficacy of *Trichoderma* spp. The study underscores the potential of these fungi as environmentally friendly and sustainable alternatives to synthetic fungicides in integrated disease management programs. Wider adoption can be promoted through formulation improvement, strain selection and awareness among growers.

Allelopathic potential of leaf aqueous extract of *Erigeron bonariensis* on germination, growth and biochemical activity of *Vicia villosa*

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ABSTRACT

Allelopathy refers to the phenomenon whereby chemical substances produced by one plant influence the growth and development of another plant. To assess the allelopathic potential of *Erigeron bonariensis* leaf aqueous extract (LAE) on weed species, *Vicia villosa*, a Petri dish bioassay was conducted. The findings indicated that higher concentrations of the extract (0.5%, 1%, 2%, and 4% RAE) significantly reduced the dry weight, fresh weight, germination percentage, plumule length, and radicle length of the crop seedlings compared to the control. A one-way ANOVA with DMRT test was performed to evaluate the impact of leaf extract on germination percentage. Pot-based analysis demonstrated a significant reduction in protein, carotenoids, and carbohydrates, along with a marked decrease in chlorophyll content, contingent on the extract concentrations. Ultra-structural examinations of leaf and root morphology using scanning electron microscopy (SEM) revealed notable differences, such as necrosis and cell shrinkage. Additionally, exposed epidermal cells exhibited noticeable changes in appearance compared to the control group. Thirty-three components were identified using a methanolic root extract profile obtained by gas chromatography-mass spectrometry (GC-MS). These substances may be implicated in the allelopathic suppression of the targeted crops. These natural compounds offer eco-friendly herbicide alternatives that promote sustainable agriculture and reduce environmental impact.

Keywords: *Allelochemicals; eco-friendly herbicide; germination percentage; scanning electron microscopy; gas chromatography-mass spectrometry (GC-MS)*

Characteristics Analysis Of Concrete Made With Construction And Demolition Waste**Swatantra Gopal and Amrendra Kumar***Department of Civil Engineering, Sandip University, Madhubani, Bihar, India.***ABSTRACT**

In rapidly urbanizing metropolitan regions, the demolition of aging infrastructure to pave the way for modern developments has become increasingly common. Despite this, the recycling and reuse of demolished concrete remain limited. The situation is further complicated by stringent environmental regulations and a shortage of designated waste disposal areas, which make the handling of demolition debris challenging. Simultaneously, sourcing natural raw materials is becoming more difficult due to restrictions on quarrying activities.

This study explores the potential of utilizing demolished waste materials as partial replacements for cement, fine aggregate, and coarse aggregate in concrete production. An experimental investigation was conducted using M25 grade concrete, designed as per IS 10262:2009 standards. Initially, a reference mix was prepared using conventional materials. Subsequent mixes were then produced by individually replacing the cement, fine, and coarse aggregates with appropriately sieved fractions of crushed demolition waste.

To evaluate the performance of these mixes, compressive strength tests were conducted on 100 mm cubes at curing intervals of 7, 14, and 28 days. Workability was assessed using slump tests. The results indicated that recycled concrete incorporating partial replacement of fine aggregates (FAR concrete) with 10%, 15%, and 20% of crushed demolition coarse aggregates achieved compressive strengths comparable to the reference mix. Additionally, concrete with 10% coarse aggregate replacement (CAR concrete) demonstrated nearly equivalent strength to that of conventional concrete. Overall, the findings suggest that higher levels of replacement are feasible without significantly affecting the 28-day compressive strength and workability of the concrete, especially with the inclusion of appropriate admixtures.

Keywords: *Urbanizing Metropolitan; Workability; Experimental Investigation; Urbanizing Metropolitan*

Practical approach of Mass scale production and Conservation of Timur (*Zanthoxylum armatum* DC.) in Uttarakhand, India**Butola¹, J. S., Praveen Joshi¹, Y. M. Bahuguna¹, Dhruv Butola¹, S. Chamoli¹, P.P. Raturi², Soumi Datta², S. Bhagat², Vinod K. Bisht²**¹*Himalayan Union for Man and Nature (HUMAN), Rudraprayag, Uttarakhand, India.*²*CBD, Dabur India Ltd., Sahibabad, UP, India***ABSTRACT**

Zanthoxylum armatum, is an aromatic shrub of South East Asia, belonging to the Rutaceae family. Traditionally, it has been utilized for culinary and medicinal purposes, and commercially exploited for the formulation of Herbal Toothpaste. Dabur India Ltd. is a leading FMCG company produces its herbal toothpaste “Dabur Lal Toothpaste” having Timur as one of the main ingredients. Due to its consistent annual demand (Av. 250 tons of fruits), Dabur and HUMAN launched a CSR project for commercial plantations of Timur within private and community lands of marginal farmers. During the last 6 years (2019 to 2024), 01 central nursery (200 m asl.) and 3 satellite nurseries (1800 to 2500m asl.) were established at suitable locations for production of its QPM using elite germplasm and standard propagation protocols. As on date, about 1.05 lakh saplings were planted in 101 Acre (1000 plants/acre) land of 550 farmers within an altitudinal range between 1000m and 2800 m asl. covering 7 hilly districts of Uttarakhand. The project ensures buy-back of the produce at the best farm level prices. After 5 years

of plantation, the very first harvesting of 4800 plants yielded 1025 kg fruits (Av. 200 gm dry fruits per plant). The best results in terms of fruit production and quality have been achieved from Munsiyari plantation (2200 to 2450 m asl. District Pithoragarh). The fruit production is estimated to be doubled (500 gm per plant) within 8-10 years of plantation. Low germination and rooting rate coupled with poor survival of the plants have been experienced amongst the major hurdles in the project. Being a thorny plant, it is one of the best plantation crops particularly for wildlife affected areas. Based on these findings, we recommend intensive studies on standardization of propagation protocol and mass scale plantation as an Orchard and/or live fencing suitable for terrace farming to ensure consistent production and supply of the raw materials to support crop diversification and livelihood security of the farmers under hill Agroforestry.

Keywords: *Timur; Zanthoxylum armatum; Medicinal shrub; Uttarakhand; Plantation; Conservation*

Spatio-Temporal Analysis of Population Growth and Distribution in Bihar

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ABSTRACT

Demographic factors are a major problem that makes it hard to manage and prepare for the growth of an area. Current study looks into all demographic processes. showing how different parts of the population are spread out in the research region and how this is affected by physical, ecological, and socio-economic factors. This research is looked at in the perspective of the state of Bihar. This thesis supports the idea that population dynamics should be taken into account when allocating resources. The analysis uses secondary data from the Census of India, the NHFS, and the NSSO. Abstract, Census of India, Directorate of Census Operation, for the years 1991 to 2011. Geographic knowledge and statistical methods have been used to show and control the pattern of population expansion in line with the size of the studied region. Demography, population projection, population distribution and density, land use, and land cover are some of the words that come to mind.

Keywords: *Demography; Population projection; Distribution and Density of Population; Land use and land cover*

Oxidative Stress Markers as Indicators of Stripe Rust Resistance in Wheat Genotypes

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ABSTRACT

Wheat (*Triticum aestivum* L.) is a globally important cereal crop, but its productivity is severely threatened by stripe rust, caused by *Puccinia striiformis* f. sp. *tritici* (Pst). The emergence of new virulent pathotypes of Pst under changing climatic conditions demands a better understanding of resistance mechanisms in wheat to ensure sustainable production. In this study, 67 wheat germplasm lines were evaluated under field conditions during the 2019–20 and 2020–21 crop seasons. Based on disease data and area under disease progress curve (AUDPC) values, six representative lines were selected for were selected for biochemical analysis to assess malondialdehyde (MDA), hydrogen peroxide (H₂O₂), and phenol content. These included three highly resistant lines (PBW725, BWL6990, BWL1789), one moderately resistant (PBW723), one moderately susceptible (PBW820), and one susceptible line (PBW343). Biochemical assays targeting oxidative stress markers—malondialdehyde (MDA) and hydrogen peroxide (H₂O₂)—revealed significant genotype-specific differences in response to *Puccinia*

striiformis f. sp. tritici (Pst) infection. MDA, a key indicator of lipid peroxidation and membrane damage, declined in resistant lines (PBW725, BWL1789), indicating effective ROS scavenging, while BWL6990 showed stable levels. In contrast, susceptible and moderately susceptible lines (PBW343, PBW820, PBW723) showed elevated MDA, reflecting greater oxidative stress. A similar trend was observed for H₂O₂ content: it decreased in resistant genotypes, suggesting active detoxification, but increased in susceptible lines, indicating poor ROS regulation. These results highlight the role of oxidative stress management in stripe rust resistance and support the use of MDA and H₂O₂ as reliable biochemical markers in wheat breeding programs.

Keywords: *Stripe rust; Malondialdehyde; Hydrogen peroxide; Resistance; Oxidative stress*

Social Network Analysis as a Lens for Understanding Social Change and Knowledge Flow in Agricultural Extension

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Motivation behind the topic

This review stems from the need to thoroughly assess Social Network Analysis (SNA) as a crucial tool for comprehending the changing social framework of agricultural extension systems in India. As agricultural communities undergo cultural changes and face emerging socioeconomic challenges, understanding the dynamics of knowledge, power, and leadership within these frameworks is essential for fostering inclusive development and sustainable change.

Descriptive statement about the types of literature used in the review

The analysis employs interdisciplinary sources, including peer-reviewed research from agricultural sociology, rural development studies, innovation diffusion theory, and systems thinking. It additionally includes practical insights from national and international development initiatives that have applied SNA in real agricultural contexts. Case studies from Africa and Asia, along with official reports and documents from organizations like FAO, IFPRI, and ICAR, provided both theoretical insights and empirical evidence.

Summary of the findings

Main findings suggest that SNA serves as a cutting-edge system for mapping intricate relationships among people, groups, and organizations. It identifies influencers, reveals communication barriers, emphasizes informal leadership, and detects patterns of marginalization. In rural India, it has successfully empowered women, prioritized marginalized groups, strengthened farmer networks, and accelerated the uptake of sustainable technologies. Importantly, Dynamic Network Analysis (DNA) has enabled prompt monitoring of evolving social structures, making extension activities more adaptable and evidence-based. The analysis highlights that historically overlooked social ties—such as family bonds, caste-based networks, and women's support systems—are crucial for the dissemination of knowledge.

Conclusion

SNA provides a robust, culturally sensitive, and evidence-driven approach for analyzing historical and contemporary patterns in agricultural extension. It not only helps build socially inclusive and resilient systems but also deepens our understanding of the social change processes that fuel agricultural transformation.

Keywords: *Social Network Analysis; agricultural extension; empowerment; social change; cultural transition; resilience; sustainability*

Influence of Foliar Application of Nano Urea and Sulphate of Potash (SOP) on Bunch and Finger Development in Tissue Culture Derived Banana (Cv. Grand Naine)**Priyanka Kumari¹, Goutam Mandal¹ and Uday Kumar²**¹*Dept. of Horticulture and Post-Harvest Technology, Palli-Siksha Bhavana, Visva-Bharati, Sriniketan, Bolpur, West Bengal, India.*²*Department of Plant Pathology, Bihar Agricultural University, Sabour, India.***ABSTRACT**

Banana originated from the tropical region of South-East Asia and is also known as the "Apple of Paradise." It is one of the major fruit crops grown in tropical and subtropical regions. Banana needs the maximum amount of nutrients at the shooting stage, but it might not be able to uptake the required amount of nutrients from the soil. Nano fertilizers have higher surface area and less particle size than the pore size of roots and leaves of the plant which can increase better penetration and absorption into the plant and can improve uptake and nutrient use efficiency of the fertilizer. Fertilizers i.e. nitrogen and potassium are one of the most important elements that can play vital role to increase productivity of banana. Hence, the present research investigation was conducted at the Horticulture Farm of Palli Siksha Bhavana, Visva Bharati, Sriniketan, West Bengal during the period from March, 2022 to April, 2023 to evaluate the effect of Nano Urea & potassium fertilizers on Bunch and finger development of banana and also find out the best combination of N & K fertilizers for economic production of banana. The results revealed that the single application of SOP=0.4 % /plant and their combination 2% SOP + 0.4 % Nano urea/plant and 1.5% SOP + 0.3% Nano Urea showed more significant increase in yield contributing characters viz. total number of fingers per bunch, total number of hands per bunch, bunch weight (kg/plant), hand weight (kg), finger weight (g) in this study. The application of these two fertilizers as single or their interaction would be the most appropriate level for getting the superior growth and yield performance of banana.

Keywords: *Nitrogen; Potassium; Morpho-physiological traits; Yield attributes and Banana***CLIMATE IMPACTS ON PESTS, DISEASES, AND MANAGEMENT STRATEGIES****Ramprem Meena¹, Laxmi Meena²**¹*Department of Agriculture Entomology, College of Agriculture, Mandor, Jodhpur, Rajasthan, India.*²*Department of Extension Education, Rajasthan College of Agriculture, Udaipur, Rajasthan, India.***ABSTRACT**

Climate change is increasingly transforming agricultural ecosystems, with profound implications for the dynamics of insect pests and plant diseases. Rising global temperatures, shifting precipitation regimes, and the increased frequency of extreme weather events are altering the distribution, abundance, and outbreak patterns of pests and pathogens. These climatic shifts have extended the geographic range, accelerated reproduction cycles, and disrupted the seasonality of many species, leading to the emergence of new threats and the resurgence of previously controlled ones. Such developments threaten crop productivity, food security, ecosystem stability, and farmer livelihoods, particularly in vulnerable regions.

By synthesizing current research on climate-induced changes in pest and disease ecology, emphasizing how altered environmental conditions create more favorable habitats for pest proliferation and facilitate the transmission of plant pathogens. It also critically evaluates the limitations of conventional management practices under climate stress and highlights the urgent need for more resilient, adaptive strategies. Special attention is given to Integrated Pest Management (IPM), biological control measures, climate-resilient cropping systems, early warning and predictive surveillance systems, and decision-support tools.

The studies suggest that explores innovative approaches such as remote sensing, data-driven modeling, and farmer-centric extension services that support early detection and rapid response. The integration of these tools is essential not only to manage existing threats but also to build long-term resilience against emerging pest and disease pressures. The abstract concludes by underscoring the need for interdisciplinary collaboration, real-time data integration, and supportive policy frameworks to design sustainable, climate-smart crop protection strategies that enhance agricultural resilience and safeguard biodiversity in a rapidly changing climate.

Keywords: *Climate change; pest dynamics; plant diseases; integrated pest management; adaptive strategies; surveillance systems; agricultural resilience*

Genetic Variability, Heritability, Genetic Advance And Correlation Studies In Pea (*Pisum sativum* L.)

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ABSTRACT

The field experiment was conducted to carry out 25 diverse genotypes of pea (*Pisum sativum* L.) at the Nidhariya Agricultural Farm of Shri Murli Manohar Town P.G college in Ballia (U.P.) during the rabi season 2023-2024. cultivars were evaluated to estimate the genetic variability, heritability and genetic advance for different characters. The experiment was laid out in Randomized Block Design (RBD) with three replications. Observations were recorded for eleven characters and mean data was subjected to various statistical analyses. It could be easily noted that treatments were highly significant for all characters i.e. days to flower, days to maturity plant height, number of branches per plant, number of pods per plant, number of seeds per plant, number of seeds per pod, test-weight and seed yield per plant. The genotypic and phenotypic coefficients of variation were highest for plant height followed by number of seeds per plant, number of pods per plant, economical yield, days to 50 % flowering and biological yield. In the present investigation, the range of heritability values in broad sense was recorded from 29.95% to 98.88% for all the characters under study. All traits had shown high heritability (broad sense) except number of branches per plant. The high genetic advance was observed for plant height, number of seeds per plant, and lowest for the number of branches per plant. Biological yield, number of seed per pod, number of pods per plant, harvest index, number of branches per plant, number of seed per pod and pod length, showed positive and highly significant correlation with seed yield per plant.

Climate smart technologies for crops under aberrant weather conditions

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ABSTRACT

Climate change poses a critical threat to global agriculture, particularly in regions like India where farming is highly dependent on weather patterns and natural resources. Increasing temperatures, irregular rainfall, extended droughts, and sudden floods are negatively impacting crop productivity, soil fertility, and water availability. Climate Smart Agriculture (CSA) offers an adaptive and sustainable framework that enhances productivity while building resilience. Key CSA strategies include conservation agriculture practices such as zero or minimum tillage, permanent soil cover, and diverse crop rotation, which collectively improve soil structure, increase water retention, and reduce greenhouse gas emissions. Agroforestry, which integrates trees into agricultural systems, contributes to carbon sequestration, supports biodiversity, and helps regulate local climates. Efficient water management methods like broad bed and furrow planting, compartmental bunding, farm ponds, and percolation tanks

improve both in-situ and ex-situ moisture conservation, making agriculture more resilient to drought. Recycling nutrients through composting and crop residue management minimizes the use of chemical fertilizers and reduces air pollution from residue burning. The System of Rice Intensification (SRI), involving younger seedling transplanting, wider spacing, and organic inputs, enhances yield, reduces water use, improves soil aeration, and cuts methane emissions. Empirical studies validate the effectiveness of these practices: zero tillage can reduce input costs by up to 80% and boost wheat productivity; agroforestry may contribute 12–15% to global carbon sequestration; crop residue incorporation enhances soil organic carbon and nutrient content; and SRI decreases water consumption while curbing greenhouse gas emissions. Adoption of such location-specific, integrated approaches helps farmers mitigate climate risks, improve profitability, and contribute to environmental health. CSA is not merely a technological innovation but represents a paradigm shift toward sustainable agriculture. Timely and widespread implementation is essential to secure food systems, improve rural livelihoods, and build long-term resilience against increasing climate variability.

Keywords: *Climate change; Greenhouse gas; aberrant weather conditions*

Precision Weed Management: Transforming Agriculture with Smart Solutions

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ABSTRACT

Weeds are a major constraint to agricultural productivity, causing crop losses exceeding \$11 billion annually in India. Traditional weed control methods—manual, mechanical, biological, and chemical—are proving increasingly ineffective due to herbicide resistance, rising labor costs, and environmental degradation. To address these issues, Precision Weed Management (PWM) has emerged as a data-driven, site-specific solution that employs advanced technologies for targeted weed control. PWM utilizes tools such as GPS, drones, sensors, robotics, and artificial intelligence to detect and treat only weed-infested zones, thereby reducing herbicide use and environmental impact. This approach enhances the precision of herbicide application and enables more sustainable crop production. Techniques like patch and spot spraying can reduce herbicide use by up to 99% without compromising effectiveness. Key components of PWM include multispectral and hyperspectral imaging for accurate weed mapping, smart sprayers and robots for targeted applications, and machine learning algorithms that distinguish between crops and weeds. Robotic innovations such as Robovator, EcoRobot, Ladybird, and RIPPA exemplify the integration of high-precision automation in weed control. Field studies in India and Europe demonstrate the practical benefits of PWM. In rice and greengram fields, drone-based spraying reduced herbicide and water usage while improving yields. Similarly, automated hoeing in soybean and sugar beet fields led to an 87–89% reduction in weed density and higher productivity. Beyond agronomic gains, PWM offers economic and ecological advantages. Farmers can reduce herbicide costs by up to 60%, while minimizing chemical exposure supports soil and water health and improves public perception of farming practices. In conclusion, Precision Weed Management is a transformative innovation for modern agriculture. As technology continues to evolve, PWM will play a vital role in achieving efficient, profitable, and environmentally responsible farming.

Keywords: *Precision weed management; GPS; artificial intelligence*

Forecasting Tomato Yield Vulnerability to Temperature Extremes: DSSAT Insights from the Malwa Plateau, Central India**Pashupati Nath Singh¹, Shakshi Kumari² and Prashant K Srivastava¹**¹*Remote Sensing Laboratory, Institute of Environment and Sustainable Development, Banaras Hindu University, Varanasi, Uttar Pradesh, India.*²*Environmental Science, Botany Department, Banaras Hindu University, Varanasi, Uttar Pradesh, India.***ABSTRACT**

Climate change-induced temperature variability poses significant risks to agricultural sustainability, particularly affecting thermally sensitive crops such as tomatoes. Tomatoes, being C3 plants, exhibit heightened vulnerability to rising temperatures, primarily due to increased photorespiration, leading to substantial reductions in growth, yield, and fruit quality. This study assesses the potential impacts of projected temperature changes on tomato productivity using the DSSAT-CROPGRO crop simulation model under two distinct future climate scenarios (SSP2-4.5 and SSP5-8.5) across the Malwa Plateau agroclimatic region of Madhya Pradesh, India. Historical temperature trends analyzed using Indian Meteorological Department (IMD) datasets indicate pronounced warming patterns, correlating negatively with past tomato yields. Future temperature projections derived from multiple CMIP6 global climate models suggest significant warming across the region, with scenario SSP5-8.5 depicting notably higher temperatures and increased variability compared to SSP2-4.5. DSSAT-CROPGRO simulations reveal a clear relationship between rising temperature and declining tomato yields, predicting substantial yield reductions under both scenarios, with greater severity and variability observed under SSP5-8.5.

Notably, considerable differences among individual climate models, including ACCESS-CM2, MIROC6, and MPI, highlight the importance of accounting for model-specific uncertainties. Model outputs indicated regional disparities, including both overestimations of average temperatures and unexpected cooling trends in certain districts such as Mandsaur, Dewas, and Ujjain, underscoring the complexity of temperature impacts at localized scales. The findings emphasize the critical need for tailored agricultural adaptation strategies to mitigate the adverse effects of rising temperatures, such as selecting heat-tolerant tomato cultivars, optimizing planting schedules, and enhancing water-use efficiency through advanced irrigation practices. These strategies will ensure sustained productivity, safeguard the economic viability of tomato farming and promote food security in temperature-sensitive agricultural regions.

Keywords: *Tomato yield simulation; Temperature variability; DSSAT-CROPGRO model; Malwa Plateau (Central India)*

Ameliorative effects of *Moringa oleifera* leaves against fipronil induced hepatotoxicity in *Clarias batrachus* (Linn.)**Chandrasahini Nirnejak and Neha jain***Department of Zoology, Guru Ghasidas Vishwavidyalaya, Bilaspur, Chhattisgarh, India.***ABSTRACT**

Fipronil, a widely used phenylpyrazole insecticide, is known to accumulate in aquatic ecosystems and exert toxic effects on non-target organisms, particularly fish. *Moringa oleifera* (MO) reported for its antioxidant properties. This study aimed to explore the ameliorative effects of MO leaves against fipronil-induced hepatotoxicity in *Clarias batrachus*. In present study total 72 fishes were divided into six groups of 12 animals each. Group I served as control, group II- IV exposed to 0.16mg/l, 0.08mg/l and 0.05mg/l of fipronil respectively and group V-VI exposed to 0.16mg/l fipronil + 5% MO and

0.16mg/l fipronil + 10% MO respectively. Experimental fishes were exposed to different sub-lethal concentrations of fipronil in groups II-VI for induction of liver toxicity and groups V-VI received MO along with fipronil for 30 days to assess its potential hepatoprotective effect. Serum biochemical markers including protein, glucose, cholesterol, triglyceride, alanine aminotransferase, aspartate aminotransferase and alkaline phosphatase levels were measured, along with histopathological examination of liver tissues. The results showed significant decrease in total protein, elevations in liver enzymes and structural liver damage in fipronil exposed fish. However, co-administration of MO leave notably mitigated these effects, as evidenced by biochemical restoration and improved liver histoarchitecture. These findings suggest that MO possesses potent hepatoprotective effect that can alleviate fipronil-induced liver toxicity in aquatic species. This highlights its potential application in aquaculture and environmental toxicology for the protection of fish health in contaminated habitats.

Keywords: *Clarias batrachus*; fipronil; hepatotoxicity; *Moringa oleifera*

Production, Protection And Policy Analysis Of Rare Endangered And Threatened Medicinal Plants In Uttarakhand State, India

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EXTENDED SUMMARY

The Indian Himalayan Region is known as the “Goldmine of medicinal plants”. The present study highlights 3Ps (Production, Protection and Policy) of RET (Rare Endangered and Threatened) medicinal plants in Uttarakhand state, India. The current status of production in connection with demand and supply gaps; effectiveness and implementation setbacks of policy and protection status of medicinal plants were studied in detail.

The study covers 10 most important RET medicinal plant species, viz. *Aconitum heterophyllum*, *Aconitum balfourii*, *Picrorhiza kurrooa*, *Saussurea costus*, *Nardostachys jatamansi*, *Valeriana jatamansi*, *Paris polyphylla*, *Swertia chirayita*, *Hippophae rhamnoides* and *Zanthoxylum armatum* which are under small scale farming and trade in Uttarakhand. Amongst the species, *P. kurrooa* and *S. costus* are under commercial production (Approx. 600 farmers, 30 ha land) due to their easy production technology, high market demand and price. The supply of *P. kurrooa* is sourced both from illegal wild harvesting and field production, however *S. costus* has been extinct from wild and therefore, supply from field production only. The cultivation of *A. heterophyllum*, *A. balfourii*, *N. jatamansi*, *V. jatamansi*, *P. polyphylla* and *S. chirayita* was found in a very limited area with a total of 10-15 farmers in district Chamoli, Uttarakashi and Bageshwar only. Therefore, these species need to undertake R&D especially on production technology and promotion for community driven-production. Plantations of *H. rhamnoides* and *Z. armatum* were found in a limited land area. Having consistent market demand, these two shrubs can be planted as orchards and/or as live fencing.

Majority growers have small and scattered land holding and practice rainfed cultivation. Lack of adequate irrigation facilities and water storage infrastructure adds to the constraint. Though the growers were keen to follow the recommended Package of Practices (PoPs), however, there seems to be a lack of field extension functionaries to guide them on technical know-how. Apart from strengthening departmental human resource capacity, efforts need to be made for improving access of information to growers through other mechanisms. Field oriented training and demonstration on best practices, regular exposure programmes for knowledge exchange between growers in other States are among few that emerged during grower discussion. Alongside training and capacity building initiatives, regular field level monitoring and assistance is also required to be provided to the farmers to address their crop production related issues. To increase the volume, it's time to enter big landholder farmers into the value

chain. Overall, there is immense scope for improving productivity of medicinal plants in the State through technology infusion, introduction of global best practices and various market led interventions. The major post-harvesting activities done by the farmers included improper washing, sorting, drying and storage practices. Subsequently, the ungraded material carries forward as it is for the trade. About 10-15% post-harvest losses were observed due to multiple reasons most prominently lack of processing facilities and technical knowledge. Each grower carries out primary processing and packing activities at its respective home yard. This leads to high resource cost, improper processing, wastages and time loss. Common service centres for these activities are completely lacking.

The fact was established that village middlemen, local traders and pharmaceutical companies play crucial roles in trade and marketing of raw materials. However, each of them has their own limitations. The village middlemen have direct linkages with the farmers but are generally unable to pay procurement costs. The local traders in spite of having paying capacity do not manage to find forward supply linkages. Likewise, the pharma companies intend to purchase the material directly from the farmers but due to multiple reasons discussed earlier restrict their access up to national traders. In this condition, the companies should come forward to identify such village middlemen and integrate them in value chain upgradation. Also, the fact establishes there that due to unclear economic profitability in medicinal plants, the insurance and banking sector is unable to frame out an effective policy to support medicinal plant cultivation.

In Uttarakhand, Forest Development Cooperation has established three madis (Rishikesh, Ramnagar and Tanakpur) for marketing of herbal produce. Due to long travel distance and uncertainty of price on sale, the growers generally avoid selling its cultivated produce through these mandis. In the present case, all the farming areas are located at quite a long distance (> 300 Km) from these mandis. Also, there are no collection centres, warehouses and other related infrastructure in the clusters. Another important issue to be addressed is that the buyers made no distinction in price between cultivated and collected produce. Decisions on the price are made solely by the buyers. In the case of Atis and Kutki, which takes two-three years to grow, the prices offered in the local market are generally the same as for illegally collected produce. Unfortunately, the cost of the gestation period required for cultivation is not factored into the price.

State regulations for the farmers, traders and industries related to cultivation, storage and export of RET medicinal plants was analysed. Commercial cultivation and trade of Atis, Kuth and Kutki, being RET species, are monitored directly by HRDI and indirectly by the Forest department (Govt. of Uttarakhand). At the time of plantation, registration from HRDI is made mandatory, subject to renewal periodically (04 years). An updated copy of registration is essentially required to get a Transit Pass (TP) for movement of the harvested materials from farm gate to the buyer's destination. Licence for storage of RET especially Kuth is issued by HRDI as in Uttarakhand, the power of Wildlife Warden is delegated to the Director HRDI. In case of export, Legal Production Certificate (LPC) is issued to the farmers by the concerned DFO (Divisional Forest Officer), however, in case of buyers, it is Legal Procurement Certificate (LPC). Registration of traders and pharmaceuticals is also mandatory particularly in case of RET species. 3Ps analysis of medicinal plants addresses the current issues and suggests community and company (buyer) driven production, the government's strictly monitored protection programs and industrial policy for RET medicinal plants.

Keywords: *RET medicinal plants; Production; Protection; Policy; IUCN; Uttarakhand, India.*

Smart Technologies in Livestock Farming**Manoj Kumar, Siddhartha Mishra and Harshvardhan Singh Purawat***Department of Animal Production, Rajasthan College of Agriculture, Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan, India.***ABSTRACT**

Smart livestock farming marks a significant advancement in Indian animal husbandry by incorporating cutting-edge technologies such as sensors, Internet of Things (IoT), artificial intelligence (AI), and big data analytics to improve productivity, animal health, and sustainability. In India, where the livestock sector contributes over 4% to the national GDP and supports the livelihoods of more than 70 million rural households, the integration of smart technologies is gaining momentum, particularly in the dairy and poultry industries. These sectors are not only economically significant but also most suited for digital transformation due to their intensive nature and potential for standardization. Precision Livestock Farming (PLF), a core component of smart farming, involves continuous and automated monitoring of individual animals, enabling timely interventions for disease prevention, optimized feeding, and efficient resource use. Key technological interventions in India include automated milking systems (e.g., in Amul's large-scale dairies), RFID-based animal identification under the National Digital Livestock Mission, and climate-controlled poultry houses in states like Tamil Nadu, Punjab, and Maharashtra. Software-driven farm management tools and cloud-based data platforms are being increasingly adopted by progressive farmers and cooperatives for better decision-making and traceability. The need for such technologies is driven by rising demand for animal protein, limited availability of land and water, climate change, and the growing emphasis on biosecurity, especially after outbreaks like lumpy skin disease and avian influenza.

These advancements highlight the potential of smart livestock farming to support India's goals of sustainable agriculture, rural development, and food security in the face of increasing climatic and demographic challenges.

Keywords: *Smart livestock farming; India; dairy sector; AI; IoT; RFID; sustainable agriculture*

Assessing the Impact of Climate Change on Livestock and Human Nutrition**Dharmendra Singh and Ajit Kumar Singh***M. M. Town P. G. College, Ballia, U.P., India.***ABSTRACT**

Climate change is a serious issue not only for India but also for the entire world. The present study reviews the impact of climate change on livestock production and its effects on human nutritional security. Adaptation and mitigation strategies for addressing climate change have also been discussed. Global warming has a negative impact on animal production, as both ruminants and non-ruminants experience heat stress when temperatures exceed their thermal comfort zone. During heat stress, animals are unable to maintain homeothermy, resulting in an increased pulse rate and respiration rate. This leads to reduced feed intake, milk production, reproductive efficiency, and an increase in mortality and morbidity. Lee et al. suggested that rising temperatures reduce forage nutritive value, which may correspondingly lead to higher methane production.

According to FAO (2017), livestock provides 18% of global energy (calories) and 34% of global protein consumption. Thus, it is a major source of nutritional security and supports livelihoods, especially in pastoral regions. A decline in livestock production can therefore significantly affect human nutritional intake. The study concludes that livestock can contribute to food security and sustainable development if managed in an economically viable, environmentally sound, and people-centered manner. The

findings suggest that maintaining fewer but higher-quality animals, improving feeding practices, and using C4 forages can reduce methane emissions while sustaining milk and meat production.

Keywords: *Livestock; Production; Adaptation; Mitigation; GHG Emissions*

Climate-Smart Agriculture and the Economics of Crop Adaptation

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ABSTRACT

Over recent decades, agriculture has faced growing pressures due to escalating global population, rising food demand, and intensifying climate volatility. The frequency and severity of extreme weather events—such as droughts, floods, heatwaves, and cold spells—have increasingly disrupted agricultural productivity, heightening risks to food security and rural economies. Simultaneously, constraints on natural resources, particularly arable land and freshwater, have been exacerbated by urbanization and unsustainable land-use practices, limiting the feasibility of expanding traditional cultivation areas.

To address these challenges, investment in the development and deployment of climate-resilient crops has emerged as a cost-effective and scalable adaptation strategy. These crops are genetically engineered or selectively bred to tolerate abiotic stresses such as heat, salinity, drought, and flooding while maintaining stable yields. This study adopts a mixed-methods approach, combining secondary data analysis, economic evaluation (e.g., cost-benefit analysis), and policy assessment to examine the viability and adoption of such crops. Technological innovations—including CRISPR/Cas9 gene editing, genomic selection, and marker-assisted breeding—are analysed alongside the role of crop wild relatives and pangenomics in enhancing resilience.

Complementary methods such as machine learning applications in phenotyping, institutional mapping, and case study comparisons will be used to assess socio-economic benefits, institutional capacity, and policy readiness. A multidisciplinary framework integrating agricultural science, development economics, and climate adaptation policy is essential for supporting scalable transitions toward climate-resilient food systems.

Keywords: *Climate-resilient agriculture; Adaptation economics; Genomic breeding; Food systems policy*

Productivity of Yam bean [*Pachyrhizus erosus* (L.) Urban] Under Varying Levels of Nitrogen and Potassium

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ABSTRACT

The present study was conducted during the rabi season of 2023-24 in the Experimental Research Station, Binjhagiri, Chhatabar, Faculty of Agricultural Sciences, Siksha 'O' Anusandhan Deemed to be University, Bhubaneswar, Odisha, India. The soil of the experimental site was clay loam in nature with organic carbon 0.49%, available nitrogen, phosphorus and potassium 191.46, 29.58 and 100.30 kg/ha, respectively. The experiment was laid out in a factorial RBD design with 4 levels of nitrogen (30, 60, 90 and 120 kg N/ha) and 3 levels of potassium (30, 60, 90 kg K₂O/ha) and replicated thrice. Among the levels of nitrogen tested, application of 120 kg N/ha was found superior to all other N levels and recorded the highest values of all growth characters. The maximum plant height (95.27cm), number of leaflets (27.21), primary branches (17.31) and leaf area (46.89 cm²) along with highest values of yield attributes viz. fresh weight of shoot (63.60 g), tuber fresh weight (312.40 g), tuber dry weight (51.35

g), tuber girth (25.89 cm) and maximum tuber yield (12.96 t/ha) were obtained with the treatment N₄ (120 kg N/ha). Likewise, the higher dose of potassium K₃ (90 kg K₂O/ha) recorded the higher values of growth characters viz. taller plant (88.73 cm), maximum number of leaflets (25.98), maximum number of primary branches (16.58) and leaf area (40.52 cm²), yield attributes viz. fresh weight of shoot (51.28 g), tuber fresh weight (276.42 g), tuber dry weight (44.71 g), tuber girth (24.23 cm) and hence, maximum tuber yield of 11.34 t/ha. The interaction effect of N x K was also significant, and the treatment N₄K₃ recorded maximum tuber yield (15 t/ha), followed by that of N₄K₂ (13.06 t/ha), and the treatment N₁K₁ recorded the minimum tuber yield of 6.53 t/ha. After 3 months of storage in ambient conditions, N₁K₃, comprising 30 kg N/ha + 90 kg K₂O/ha, resulted in the minimum (66.93%) tuber rotting compared to all other treatments.

Keywords: *nitrogen; potassium; productivity; yam bean*

Altering growth attributes of dragon fruit by rhizosphere fortification

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ABSTRACT

Dragon fruit (*Hylocereus* spp.), recognized for its nutritional and economic significance, has become more popular in tropical and subtropical areas. However, enhancing its growth and production through organic and integrated nutrient management approaches keeps presenting challenges. While separate organic treatments have been evaluated, there is less data about the effects of mixing organic manures with bio-enhancers (such as jeevamrut) on vegetative growth, yield, and quality characteristics. The present investigation was carried out at the experimental site of Agricultural Research Station, Binjhagiri, Chhatabara, of Siksha "O" Anusandhan (Deemed to be University), Bhubaneswar during year 2023-24. The experiment was conducted in randomized block design having 7 treatments in four replications. Maximum values for the vegetative, yield and yield attributing parameters were recorded under plant receiving recommended dose of fertilizers. However, the plants receiving either vermicompost alone or combination with FYM, along with jeevamrut showed at par response with chemical fertilizer, suggesting the effect of rhizosphere fortification through microbes of jeevamrut has a significant role in up-scaling the yield and yield attributing properties. Plants treated with 50% N through vermicompost along with 200 ml Jeevamrut (T₅) showed maximum in reducing sugar (11.55%), TSS (16.25°Brix), minimum acidity (0.28%), maximum DPPH free radical scavenging activity (238.50 µg/ml), organic carbon (0.70%), bacterial population (11.35 × 10⁵ cfu/g) and fungal population (7.04 × 10⁴ cfu/g). Application of organic manures both in solid as well as in liquid formulation is a promising approach to increase the vegetative growth and maintained the soil health of dragon fruit plant.

Keywords: *Dragon fruit; rhizosphere fortification; organic liquid manure; soil health; fruit quality*

A Review on Smart Mobility Solutions and Infrastructure Management of Smart Cities

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ABSTRACT

Transportation asset management is a critical component in the development and sustainability of smart cities. This research paper aims to analyze the challenges and limitations in transportation asset

management within smart cities and explore potential solutions leveraging smart technologies and data-driven approaches. The study identifies key issues such as aging infrastructure, limited funding, increasing demand, changing mobility patterns, and technological advancements. It discusses existing gaps and limitations, including inadequate asset monitoring, limited data integration and analytics, lack of predictive maintenance, and insufficient consideration of emerging technologies. The implications of these problems on transportation efficiency, environmental sustainability, economic growth, public safety, and quality of life are examined. The research methodology involves a systematic description of the urban transportation system, a hierarchical approach to total transportation management, and a general optimization method for analyzing and optimizing transportation assets. The paper proposes strategies and solutions for improving transportation asset management, assesses the potential benefits and impacts, and provides guidance for policymakers and stakeholders. By addressing the identified challenges and leveraging smart technologies, this research aims to contribute to the advancement of sustainable and efficient transportation systems in smart cities.

Keywords: *Transportation asset management; smart cities; urban transportation; asset monitoring; data integration; predictive maintenance; emerging technologies*

Agroforestry for Climate Adaptation and Environmental Conservation: A Pathway to Sustainable Landscapes

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ABSTRACT

Agroforestry, the deliberate integration of trees, crops, and sometimes livestock on the same land, offers a transformative solution to the interconnected challenges of climate change, land degradation, and biodiversity loss. By merging ecological and economic functions, agroforestry enhances climate adaptation and strengthens environmental conservation efforts. Trees in these systems regulate microclimates, improve soil structure, and enhance water retention, making farmlands more resilient to droughts, floods, and other extreme weather events. Moreover, agroforestry contributes significantly to climate change mitigation through carbon sequestration, while enriching soil organic matter and reducing erosion.

Beyond its climate benefits, agroforestry supports biodiversity by creating habitat corridors and fostering species diversity in otherwise uniform agricultural landscapes. It rehabilitates degraded land, reduces dependence on chemical fertilizers, and improves nutrient cycling, sustaining soil fertility for long-term productivity. Economically, agroforestry diversifies income for farmers by producing timber, fruits, fodder, and non-timber forest products, thus reducing vulnerability to market fluctuations and climate shocks.

Aligned with global sustainability frameworks, including the UN Sustainable Development Goals (SDGs), agroforestry simultaneously addresses food security, poverty alleviation, and ecosystem restoration. Its multifunctional role makes it a critical tool for integrating production with conservation, ensuring landscapes remain both productive and ecologically balanced.

Scaling up agroforestry through policy incentives, research, and community participation is essential for building climate-resilient ecosystems. By linking livelihoods with ecological restoration, agroforestry emerges not only as a farming practice but as a pathway toward sustainable landscapes and a secure future for generations to come.

Keywords: *Agroforestry; Carbon Sequestration; Biodiversity; Sustainable Agriculture; Land Restoration; Climate Resilience*

Community Perceptions and Participatory Stewardship in the Conservation of Carbon-Dense Sacred Groves: A Case Study from Jashpur District, Central India**Jaimangal Tirkey¹, Dayanand Sai Pankra² and Manish Kumar Mankur¹**¹*Sant Gahira Guru University Surguja, Ambikapur, India.*²*Centre for Indian Knowledge System, Indian Institute of Technology Roorkee, Uttarakhand, India.***ABSTRACT**

Sacred groves, culturally protected forest fragments, serve as vital socio-ecological systems contributing to biodiversity preservation and terrestrial carbon sequestration. This study examines the carbon storage potential of sacred groves and the influence of indigenous community stewardship in Jashpur district, Chhattisgarh.

Five sacred groves—Sardih, Echkela, Konbira, Bataikela, and Kersai—were assessed for species composition, community perception, and per-tree carbon stock. A total of 78 woody species were recorded, with *Shorea robusta*, *Terminalia tomentosa*, and *Diospyros melanoxylon* dominating the flora. Community surveys revealed that 90% of respondents regard sacred groves as spiritually protected spaces, while 83% recognize their role in ecological balance and climate regulation.

Biomass and carbon stock were estimated using standard allometric equations. Among the groves, Sardih contributed the highest proportion to total carbon stock (21.35%), followed by Echkela (20.41%), Konbira (20.29%), Bataikela (19.57%), and Kersai (18.40%). The results reveal that traditional protection has facilitated the conservation of high-biomass tree species, leading to significant per-tree carbon accumulation.

This study underscores the synergistic role of cultural heritage and ecological function in sustaining carbon-rich ecosystems. It advocates for the inclusion of sacred groves in national climate mitigation frameworks such as REDD+ and emphasizes the need to recognize indigenous knowledge systems as integral to climate-resilient conservation planning.

Keywords: *Sacred groves; carbon stock percentage; community-based conservation*

Precision agriculture and soil/water conservation innovations**Ghanshyam¹ and Pinki²**¹*Agriculture University, Jodhpur, Rajasthan India.*²*Department of Agronomy, CCSHAU, Hisar India.***ABSTRACT**

Precision agriculture (PA) represents a transformative approach to modern farming by integrating advanced technologies for efficient and site-specific agricultural management. It focuses on using data-driven insights to enhance productivity, optimize resource use, and minimize environmental impacts. Soil and water conservation, critical components of sustainable agriculture, have significantly benefited from PA innovations, which enable better decision-making, real-time monitoring, and precise input application of resources.

At the core of precision agriculture lies the use of tools such as Geographic Information Systems (GIS), Global Positioning Systems (GPS), remote sensing, and drones, which allow for accurate mapping of field variability. These technologies help farmers assess soil health, monitor crop conditions, and track moisture levels at a micro-scale. By analyzing this data, farmers can adopt variable rate technology (VRT) to apply water, fertilizers, and pesticides only where needed, thereby reducing input wastage and conserving resources.

One key innovation in soil conservation is the deployment of soil moisture sensors and automated irrigation systems, which ensure that water is applied only when and where required, minimizing runoff and soil erosion. Conservation tillage practices such as zero-tillage and strip-tillage have gained

popularity, reducing soil disturbance and preserving soil structure and organic matter. Additionally, cover cropping and contour farming help in preventing soil degradation and enhancing fertility. In terms of water conservation, drip irrigation and sprinkler systems, guided by precision data, have significantly improved water use efficiency. Advanced irrigation scheduling tools now use weather forecasts, evapotranspiration rates, and soil moisture data to inform optimal irrigation timings. Rainwater harvesting systems, when combined with PA tools, offer localized solutions for water-scarce regions, ensuring year-round water availability for crops.

Data analytics and artificial intelligence (AI) models are increasingly used to predict weather patterns, drought risks, and water demand, enabling proactive farm management. Mobile applications and cloud-based platforms facilitate real-time data sharing and decision support, making precision farming accessible even to smallholder farmers.

These innovations not only enhance crop productivity and farm profitability but also contribute to long-term soil health, water sustainability, and climate resilience. By promoting the efficient use of natural resources, precision agriculture supports global efforts towards sustainable development goals (SDGs), particularly those related to food security, water conservation, and environmental protection.

In conclusion, integrating precision agriculture with innovative soil and water conservation practices provides a holistic and sustainable pathway for the future of agriculture. As technology becomes more affordable and accessible, its adoption is expected to grow, empowering farmers to produce more with less, while preserving essential natural resources for future generations.

Keywords: *Precision agriculture; Remote sensing; GPS; GIS; Sustainable development goals; Zero tillage; Irrigation scheduling*

The environmental impact of the digital world (e-waste, energy consumption).

Sushila and Seema Tyagi

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ABSTRACT

Electronic waste, often known as E-waste, is a category of refuse generated from electronic devices. In today's industrialized world, waste management has become one of the most complex and rapidly growing challenges. E-waste consists of obsolete or end-of-life electronic equipment such as computers, laptops, televisions, generators, DVD players, mobile phones, refrigerators, and other similar items. These devices are usually discarded by their original users due to their limited lifespan or functional obsolescence. Hence, this review presents a compendium of various sources of E-waste, environmental hazards, its composition and characterization, E-waste scenarios in India and global world. Now, the situation is alarming as a huge quantity of waste is generated by India as well as other countries. The condition in India is much worse because about 80 percent of the e-waste generated in the US is exported to India, China and Pakistan under the name of charity. Only 3% of total WEEE- E (waste from electrical and electronic equipments) waste generated is recycled properly in India. It causes both environmental as well as health problems. Number of laws are framed but none is able to stop this informal recycling. In this paper, national and international e-waste scenario is discussed along with hazards caused by e-waste and bit about its recycling. During the finding it has been found that there is an urgent need to address the issues related to E-waste in India in order to avoid its detrimental future consequences.

Keywords: *E-waste management; Environmental pollution; Human health; E-waste recycling*

Pipette Tip Approach For Enhancing Finger Millet Growth And Nutrient Content Under Salinity Through Fungal Hormones**Sunita Pandurang Mahadik and Belur Satyan Kumudini***Department of Biotechnology and Genetics, School of Sciences, JAIN (Deemed-to-be University), Bengaluru, Karnataka, India.***ABSTRACT**

Soil salinity poses a serious threat to global agricultural productivity. This study investigated the potential of the rhizosphere fungus *Aspergillus sojae* JUSPF-101 to enhance salinity tolerance in finger millet (*Eleusine coracana*) seedlings. In addition, the ability of *A. sojae* to produce phytohormones was evaluated. Seedlings, both primed and unprimed, were subjected to NaCl-induced stress using Petri dish and pipette tip bioassays. A greenhouse experiment further assessed physiological and biochemical responses under two NaCl concentrations (0 and 400 mM), with or without *A. sojae* inoculation.

In the present study, *A. sojae* demonstrated high salt (up to 1200 mM NaCl) and temperature (up to 45 °C) tolerance. LC-MS/MS analysis identified fifteen phytohormones in *A. sojae* cultures grown under control and 400 mM NaCl conditions, including IAA, SA, epibrassinolide, zeatin (trans isomer), and cis-jasmone. The pipette tip assay yielded superior seedling morphology compared to the Petri dish method. Under greenhouse conditions, NaCl stress significantly reduced relative water content (RWC) and beneficial biochemical traits while increasing oxidative stress markers (MDA and H₂O₂). However, *A. sojae* treatment mitigated these effects, enhancing RWC, antioxidant levels, and mineral uptake.

Specifically, under 400 mM NaCl stress, *A. sojae*-treated seedlings showed improved shoot and root length, and increased levels of proline (1.67-fold), phenols (2.15-fold), and flavonoids (2.04-fold), while MDA and H₂O₂ contents decreased by 1.2- and 1.25-fold, respectively, compared to unprimed controls. Additionally, treated seedlings exhibited lower Na⁺/K⁺ and Na⁺/Ca²⁺ ratios. These results highlight the potential of *A. sojae* JUSPF-101 as a biostimulant for enhancing salinity tolerance in finger millet, contributing to sustainable crop production under saline conditions.

Keywords: *Soil Salinity; Finger Millet; Aspergillus sojae; Seed Priming; Pipette Tip Approach; Phytohormones; Proline; Siderophore*

Reproductive stage drought screening of QTL-introgressed rice lines of elite variety Jyothi**Shankar C¹, Abida P. S¹, Jiji Joseph², Rose Mary Francies³, Deepu Mathew¹, Beena R⁴**

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ABSTRACT

Drought stress during the reproductive stage is a major abiotic constraint that severely limits rice yield. Jyothi, a high-yielding and widely cultivated rice variety in Kerala, exhibits high spikelet sterility under drought conditions, highlighting its susceptibility. To overcome this limitation, a marker-assisted backcross breeding (MABB) program was initiated at Kerala Agricultural University to introgress three major drought-yield QTLs namely qDTY_{4.1}, qDTY_{6.1}, and qDTY_{9.1} from the drought-tolerant donor variety Chuvannamodan into the genetic background of Jyothi. Parental polymorphism assessment identified 85 polymorphic SSR markers. Foreground selection of 27 true F₁ hybrids was performed using RM518, RM587, and RM566 linked to the target QTLs. These hybrids were backcrossed with Jyothi to produce 200 BC₁F₁ plants, of which 60 carried at least one QTL. Further, 27 plants were found

to possess two QTL combinations. Background selection using 76 polymorphic SSR markers revealed recurrent parent genome recovery up to 57.7%. Phenotypic screening under reproductive stage drought revealed superior performance of pyramided lines over Jyothi. Notably, line 20.118 (qDTY_{4.1} + qDTY_{6.1}) had 41 filled grains per panicle with reduced spikelet sterility (49.38%) versus Jyothi (1 FG, 99.29% SS). Line 1.10 (qDTY_{9.1} + qDTY_{4.1}) showed enhanced root traits like root length and volume, and lines 23.153 and 3.30 showed delayed leaf rolling. The developed QTL-pyramided lines represent a valuable resource for improving drought resilience in Jyothi and support the development of climate-resilient rice cultivars adapted to drought-prone ecosystems.

Keywords: *Jyothi; SSR; MABB; reproductive stage; Drought stress*

Fodder Usage Patterns Along an Altitudinal Gradient in the Central Himalayas: A Socio-Ecological Analysis

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ABSTRACT

The present study was carried out to assess the patterns of fodder usage across distinct altitudinal gradients in Pokhari Block, Chamoli district, Uttarakhand, Central Himalaya. The study aimed to understand better seasonal fluctuations in resource collection, species choice, socioeconomic dependence and ecological effects. Primary data was gathered via household surveys, field observations, quadrat sampling, and phytosociological analysis in three elevation ranges: lower (1000-1500 m asl), middle (1500-2000 m asl), and higher (2000-2500 m asl). The study identified 65 fodder species, comprising 35 trees, 14 herbs, 10 grasses, 5 shrubs, and 1 climber. These species belong to various families, with Poaceae being the most represented (14 species), followed by Moraceae, Rosaceae, Caesalpinioideae (4 species), Pinaceae, Sapindaceae (3 species), Fabaceae, Fagaceae (2 species), and Cannabaceae (1 species). At a lower altitude, 20 species were mainly used during the summer, while 15 were available all year. At higher altitudes, 22 species were preferred in winter, indicating climate-driven heterogeneity in resource utilisation. The phytosociological data revealed variations in species dominance and dispersion. *Dendrocalamus strictus* dominated the lower altitude, while *Quercus leucotrichophora* and *Pinus roxburghii* dominated the middle and upper altitudes. During the rainy season, Sawai Malla had the highest average collection of fodder (81.75 kg household/day) at a lower elevation, while Bamanthala had the lowest (55.05±1.38 kg household/day) at a higher elevation. In the winter, the highest fodder collection was recorded in Sawai Malla (56.12±0.43 kg household/day), while the least was recorded in Bamanthala (27.5±0.74 kg household/day). In autumn, the highest fodder collection was recorded from Panai (53.75±2.351 kg household/day), while the least 25.4±1.466 kg household/day from Bamanthala. Socioeconomic studies found that collection intensity was related to landholding size, livestock count, alternative income sources, and forest vicinity. A customised fodder extraction calendar mapped major species' availability and extraction times across altitudes and seasons. A significant difference between Seasonal availability and use patterns of fodder was observed among altitudes. The current study concluded that the people at lower elevations are more dependent on fodder collection for their livestock compared to those at middle and higher elevations. This research provides critical insights for resource management, sustainable livelihoods, and policy formation in alpine ecosystems where forest dependence remains high.

Keywords: *Altitudes; Fodder; Livelihood; Himalaya; Household; Sustainable*

Evaluation of Drought tolerance of rice genotypes

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ABSTRACT

Two third part of the world are consuming rice as the staple food. However, climate change is posing a severe threat to the sustainable rice production. Therefore, there is need of identifying potential drought tolerant donors. To identify rice germplasm with built in tolerance to vegetative stage drought, 82 germplasm accessions including tolerant (N22) and susceptible (IR 64) checks were screened in small plastic cups in completely randomized design comprising 3 replications each. Equal amount of finely ground soil was filled in the cups and its water holding capacity was determined. Plants were grown for 28 days after germination with normal irrigation and then it was withdrawn till the susceptible check showed permanent wilting. Everyday, 30 ml of water was added to each cups and transpiration was measured on daily basis by weighing the cups daily. Out of 82 genotypes, eight genotypes were found to be drought tolerant having the biomass reduction less than 40%. Som Nghe an, IR 2003-P7-7-4-2 and CNA 7\BO\1\1>33-13-6-1 were found to had 30-35% reduction in shoot biomass under drought stress were considered as the promising one.. In the climate change scenario, these genotypes can be used as donor for development of drought tolerant genotypes.

Keywords: Drought; rice; climate change

Adaptive Strategies for Managing Biotic and Abiotic Stresses in Livestock under Climate Change

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ABSTRACT

Climate change poses significant challenges to livestock production globally by intensifying both biotic stresses (such as diseases and parasites) and abiotic stresses (such as heat stress, drought, and water scarcity). Variations in temperature, irregular rainfall and extreme climatic conditions negatively influence animal health, productivity, reproductive efficiency, and overall welfare. Livestock farming itself accounts for nearly 14.5% of global anthropogenic greenhouse gas emissions, yet it remains highly sensitive to climate fluctuations. For instance, elevated temperatures can cause a 25–30% drop in milk production in dairy animals, while each 1°C increase beyond the optimal thermal threshold may reduce cow fertility by about 20%. Drought conditions further aggravate the issue by degrading pasture quality, leading to a 15–50% reduction in feed availability. Climate change is also increasing the causes of biotic

stresses, as warmer and more humid conditions promote the spread of vector-borne diseases such as theileriosis, bluetongue and babesiosis.

To mitigate these impacts, a varied approach is essential. This includes the promotion of genetically adapted and climate-resilient livestock breeds, strategic nutritional measures (such as incorporating antioxidants or electrolytes in feed), climate-smart infrastructure like ventilated shelters or sprinklers, and the deployment of precision livestock farming (PLF) tools for early disease identification. On a policy level, implementing climate-livestock integration plans and risk-buffering instruments like insurance schemes is key. Field experiences in India have demonstrated that using shade and water-cooling methods can increase milk yield by 12–18% during summer months. Additionally, native breeds like Gir and Sahiwal have shown superior adaptability to heat and disease compared to exotic breeds when exposed to the same environmental stresses.

Keywords: *Climate; stress; livestock; PLF; animal health*

Advances in Serological Techniques for Virus Detection in Horticultural Crops

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ABSTRACT

Viral diseases are a major constraint in horticultural crop production, causing significant yield losses and quality deterioration. Early and accurate detection of plant viruses is essential for effective disease management and the implementation of quarantine measures. Among various diagnostic approaches, serological techniques have gained prominence due to their simplicity, specificity and suitability for large-scale screening. Recent advances in serological methods such as enzyme-linked immune sorbent assay (ELISA), immune strip tests (lateral flow devices) and tissue blot immune assay (TBIA) have improved virus detection efficiency in fruits, vegetables and ornamental plants. The application and recent developments in serological diagnostics for detecting economically important viruses like Tomato leaf curl virus, Cucumber mosaic virus and Banana bunchy top virus. Improvements in monoclonal antibody production, recombinant antigen-based assays and multiplexing capabilities have enhanced the sensitivity, specificity and portability of these techniques. Field-deployable rapid test kits have made on-site virus detection more accessible to farmers and extension workers. Comparative evaluation of ELISA and lateral flow assays under laboratory and field conditions showed high accuracy and cost-effectiveness, especially in virus indexing programs and plant certification schemes.

Physicochemical Characteristics and Antioxidant Potential of Stingless Bee Honey from Manipur

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ABSTRACT

Honey is an important ingredient in traditional medicine. The therapeutic potential is largely attributed to its complex composition of phenolics and other bioactive compounds which vary with its entomological and botanical origins. Among different honeys, stingless bee honey is valued by traditional healers. This study evaluated physicochemical characteristics, total phenolic content (TPC), total flavonoid content (TFC), and antioxidant activities of stingless bee honey from Manipur, India (Indo-Myanmar biodiversity hotspot) using standard methods, and compared to *Apis cerana* and *Apis dorsata* honeys. Stingless bee honey was darker in colour. Moisture content was similar across all honey types (21–26%). Its reducing sugars (54%) were lower than *A. dorsata* and *A. cerana* (both 63%). Its pH (3.9) was similar to *A. cerana* but was lower than *A. dorsata* (5.5). Its proline content was higher

(994 mg/kg for stingless bee vs. 341 for *A. cerana* and 408 for *A. dorsata*). Its electrical conductivity (1.15 mS/cm) is higher than *A. cerana* (0.86 mS/cm) but was lower than *A. dorsata* (1.38 mS/cm). The stingless bee honey exhibited significantly higher bioactive content: TPC (105 mg GAE/100g for stingless bee vs. 72 for *A. dorsata* and 59 for *A. cerana*); TFC (12 mg QE/100g for stingless bee vs. 5 for *A. cerana* and 4 for *A. dorsata*). Its antioxidant activity was superior: DPPH radical scavenging (95 mg AAE/100g for stingless bee vs. 52 for *A. dorsata* and 46 for *A. cerana*); ferric reducing antioxidant power, FRAP (106 mmol Fe²⁺/100g for stingless bee vs. 84 for *A. dorsata* and 82 for *A. cerana*). These findings highlight the unique physicochemical characteristics and antioxidant profile of Manipur stingless bee honey illustrating its promising nutraceutical and therapeutic potential.

Keywords: *Stingless bee honey; physicochemical characteristics; antioxidant potential; Manipur*

Assessment Of Nutritional Status and Dietary Practices Among Adolescent Girls In An Agricultural University

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ABSTRACT

This cross-sectional study was conducted to assess the nutritional status and dietary practices of adolescent girls aged 17–19 years enrolled in the B.Sc. Community Science program at Swami Keshwanand Rajasthan Agricultural University (SKRAU), Bikaner. A sample of 30 participants was selected through random sampling. Data collection included anthropometric measurements, biochemical assessments (haemoglobin levels), clinical examinations and 24-hour dietary recalls. The findings revealed that 40 per cent of the participants were underweight and 83.3 per cent were anemic (haemoglobin <12 g/dl), indicating a high prevalence of undernutrition and micronutrient deficiencies. Dietary intake analysis showed inadequate consumption of key food groups—particularly cereals, pulses, fruits, and vegetables—and nutrient intakes were significantly below the Recommended Dietary Allowances (RDA) for energy, protein, fat, iron and calcium. Despite their academic exposure to nutrition science, participants exhibited poor dietary behaviour and nutritional outcomes. These results underscore the gap between nutritional knowledge and its application in personal health practices. The study recommends urgent interventions including iron supplementation, enhanced nutrition education with practical focus, routine health monitoring, and improvements in campus dietary services to bridge this knowledge–practice divide and promote better nutritional health among adolescent girls in academic institutions.

Keywords: *Adolescent girls; Nutritional status; Dietary practices; Anemia; Anthropometry; BMI; Nutrient intake; Food consumption*

Assessment of Contamination Threats and Sterility Restoration Methods During Explant Handling in Plant Tissue Culture

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ABSTRACT

Plant tissue culture is a foundational technique in plant biotechnology, facilitating the propagation, conservation, and genetic improvement of plant species under sterile and controlled in vitro conditions. However, one of the major challenges to successful culture establishment and maintenance is microbial contamination—particularly during the subculturing of explants into fresh media. Despite initial sterilization, latent microbial populations such as endophytic bacteria and fungi can become active upon

transfer, leading to contamination, inhibited growth, and culture loss. Contamination during explant subculture often arises from incomplete surface sterilization, endogenous microbial colonization, or lapses in aseptic handling. Typical symptoms include turbidity of the culture medium, tissue browning, leaf necrosis, and suppressed organogenesis. Frequently reported contaminants include *Bacillus*, *Pseudomonas*, *Aspergillus*, *Penicillium*, and *Fusarium*. Rapid identification of contamination sources through microbial isolation, microscopy, and PCR-based diagnostics is essential for early intervention. To mitigate these risks, stringent aseptic procedures are required. The laminar airflow workstation must be disinfected thoroughly, and tools such as scalpels and forceps should be flame-sterilized prior to use. Culture vessels should be opened only within the sterile field. Moreover, explants should not be transferred directly from one vessel to another without prior preparation. Removal of senescent or damaged leaves before subculturing is strongly recommended, as such tissues may desiccate in fresh media, inhibit new growth, and harbor residual microorganisms. This study evaluates conventional decontamination practices, including chemical sterilants (e.g., sodium hypochlorite, ethanol), and antimicrobial agents like cefotaxime and streptomycin, as well as the use of plant preservative mixtures (PPMs). In addition, emerging approaches such as nanoparticle-based antimicrobials, thermotherapy, and meristem tip culture are highlighted for their potential in managing persistent contaminants. Ultimately, the integration of optimized sterilization techniques, routine contamination screening, and strict handling protocols can significantly improve the reliability, efficiency, and reproducibility of in vitro plant regeneration systems—thereby supporting both research and large-scale commercial applications in plant biotechnology.

Keywords: *Explant; Contamination; Culture; Subculture; Sterilization*

Integrated Weed Management: A Sustainable Approach for Crop Productivity

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ABSTRACT

Weeds are among the most significant biotic constraints affecting agricultural productivity worldwide. Traditional reliance on single-method weed control, particularly chemical herbicides, has led to various challenges including herbicide resistance, environmental contamination, and adverse effects on soil and human health. Integrated Weed Management (IWM) offers a sustainable and holistic solution by combining multiple weed control strategies—cultural, mechanical, biological, and chemical—based on ecological principles and crop-specific requirements. The IWM approach emphasizes preventive measures such as crop rotation, use of clean seeds, optimum planting geometry, and mulching, alongside timely mechanical weeding and selective herbicide application. The integration of biological agents, such as allelopathic crops or natural weed predators, further enhances weed suppression while maintaining ecosystem balance. IWM also contributes to minimizing herbicide use, delaying resistance development, and conserving beneficial flora and fauna. This strategy not only improves weed control efficacy but also enhances soil health, crop yield, and farm profitability. The adaptability of IWM practices to local agro-ecological conditions makes it suitable for both smallholder and large-scale farming systems. Moreover, with increasing climate variability, IWM supports resilience by promoting biodiversity and reducing dependency on external inputs.

In conclusion, Integrated Weed Management is a practical and environmentally responsible approach for achieving sustainable crop production. Widespread adoption of IWM practices through farmer education, policy support, and research innovation is vital to ensure food security, ecological stability, and economic viability in modern agriculture.

Keywords: *Integrated Weed Management; Sustainable Agriculture; Herbicide Resistance; Crop Productivity; Soil Health*

Microencapsulation of Entomopathogenic Fungi: A Novel Strategy for Sustainable Lepidopteran Pest Management

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ABSTRACT

The escalating global population has intensified the demand for food production, leading to increased reliance on chemical pesticides in agriculture. Although effective, this dependency raises serious environmental and ecological concerns, prompting the need for sustainable pest management strategies. Entomopathogenic fungi (EPFs), such as *Metarhizium rileyi* and *Beauveria bassiana*, have gained attention as eco-friendly alternatives. However, their effectiveness under field conditions is often hindered by environmental stressors like ultraviolet (UV) radiation and temperature fluctuations, which adversely affect spore viability and persistence. To address these challenges, recent research has focused on advanced formulation technologies such as microencapsulation using biopolymers through complex coacervation, which enhances spore protection and allows sustained release. The present study was carried out to evaluate the efficacy of microencapsulated *M. rileyi* and *B. bassiana* formulations along with its unencapsulated and commercial formulations against the semilooper (*Achaea janata*) and tobacco caterpillar (*Spodoptera litura*) through pot culture experiments on castor and groundnut crops. Among the treatments, microencapsulated *M. rileyi* at 6 g/L recorded the highest larval mortality, with 91.67% in *A. janata* and 88.33% in *S. litura*. This was followed by microencapsulated *B. bassiana* at 6 g/L, which achieved 85.00% and 83.33% mortality, respectively. In comparison, unencapsulated formulations showed lower efficacy. The *M. rileyi* unencapsulated formulation resulted in 70.00% and 68.33% mortality, while *B. bassiana* recorded 68.33% and 66.67% mortality in *A. janata* and *S. litura*, respectively. These findings clearly demonstrate the enhanced effectiveness of microencapsulated EPF formulations in managing lepidopteran pests under controlled conditions and underscore their potential as effective components of sustainable agricultural pest management strategies.

Keywords: *Microencapsulation; Beauveria bassiana; Metarhizium rileyi; UV radiation; Spodoptera litura; Achaea janata*

Extent of Market Integration and Price Discovery in Major Castor Markets in India

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ABSTRACT

The analysis of market integration and price discovery for the national markets is essential for enhancing marketing efficiency by providing timely price signals to all marketing agencies. The present study investigates the market integration and price discovery analysis of castor across five major APMC wholesale markets in India, i.e., Kurnool, Thara, Patan, Sumerpur, and Adoni, alongside spot and futures prices sourced from AGMARK-NET and the National Commodity and Derivative Exchange (NCDEX). The study used monthly price data from April 2015 to March 2024. The Augmented Dickey-Fuller (ADF) test, Johansen co-integration, Vector Error Correction model, and Granger causality test were used as primary analytical tools. The lag selection based on Akaike Information Criterion (AIC) identified lag one as optimal. All markets were stationary after first-order differencing I(1), confirmed by the result of the ADF test. The Johansen co-integration identified the presence of five cointegrating

equations, showing the long-run equilibrium among selected markets. The error correction term coefficients were found to be negative for all markets, suggesting that short-run deviations in these markets are self-correcting and prices revert toward long-run equilibrium. The Kurnool market exhibited the fastest speed of adjustment, correcting 40.84 per cent of its disequilibrium within a month. The results of the Granger causality test revealed that out of a total of 49 market pairs, only 10 market pairs showed unidirectional causality. The information flow was found to be maximum in the Kurnool market compared to the other markets. Overall, the study highlighted significant long-run integration among castor markets, with limited short-run causal linkages.

Keywords: *Castor; Market Integration; Price Discovery; Vector Error Correction model; Equilibrium*

Climate-Smart Agriculture through Carbon Farming: A Sustainable Path to Soil Health and Food Security

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ABSTRACT

The accelerating pace of climate change poses a serious threat to global agriculture, food security and environmental sustainability. Rising greenhouse gas (GHG) emissions of which nearly a quarter originate from agricultural activities have intensified global warming and disrupted natural resource cycles. Carbon dioxide (CO₂), the most prevalent GHG, has surged from pre-industrial levels of 280 ppm to over 417 ppm in 2023. This dramatic rise is primarily driven by fossil fuel use and unsustainable land management practices, including deforestation and excessive tillage, which lead to the depletion of soil organic carbon (SOC). Declining SOC not only contributes to atmospheric CO₂ but also compromises soil fertility, structure and biological function, undermining the long-term viability of food systems. In response, carbon farming has emerged as a practical and scalable climate-smart approach. It promotes a suite of regenerative agricultural practices such as cover cropping, agroforestry, conservation tillage and rotational grazing that enhance the natural carbon storage capacity of soils and vegetation. Beyond carbon sequestration, these practices improve soil health, boost productivity and build resilience against climate extremes like drought and flooding. Although completely eliminating agricultural emissions by 2050 may be unfeasible, adopting carbon farming at scale can significantly reduce the sector's climate footprint while supporting rural livelihoods. Integrating carbon farming into national climate strategies, along with incentive-based mechanisms like carbon credits, offers a promising pathway toward achieving both climate goals and food security in a warming world.

Keywords: *Carbon dioxide; Carbon farming; Climate change; Food security; Greenhouse gas*

Mapping a Decade of Research Trends on Onion Peel Waste Valorization

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ABSTRACT

The global agro-industrial industry is currently facing a major challenge in the management of organic waste generated in large quantities. Onion peel/skin, as one of the most neglected agricultural wastes, has high potential as a source of useful bioactive compounds. This study aims to map the trends and

directions of research related to the valorization of onion skin waste in the period 2014-2024 through a scientometric approach. Data were retrieved from the DOAJ database with a total of 71 articles analyzed. The study results showed a significant increase in the number of publications since 2021, with the main focus on antioxidant activity, extraction methods, and applications in the pharmaceutical and agro-industry sectors. The findings suggest that onion peel waste is increasingly seen as a high-potential resource to be developed in the context of sustainability and circular economy. The authors also uncovered the potential utilization of onion skins in areas that have not been widely studied. It is anticipated that this study will serve as a foundational framework for subsequent research endeavors and the advancement and implementation of onion skins across diverse domains.

Keywords: *onion peel/skin; waste valorization; research mapping; sustainable agro-industry*

Understanding Impact of Different Forest Fire Severity in Chir Pine (*Pinus roxburghii*) and Banj Oak (*Quercus leucotrichophora*) Forest of Uttarakhand.

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ABSTRACT

Forest fires are a recurrent ecological disturbance in the Himalayan region, significantly influencing forest structure, soil health, and biodiversity. Climate change, global warming and associated changes in weather patterns is a significant factor in the rising frequency and intensity of forest fires across the globe. This study aims to understand the impact of different forest fire severity on key soil physico-chemical properties (e.g., pH, EC, organic carbon, available nitrogen, phosphorus, and potassium) and vegetation structure and composition in **Chir Pine (*Pinus roxburghii*)** and **Banj Oak (*Quercus leucotrichophora*) of Uttarakhand**. Sentinel 2 satellite data was used to obtain differenced normalised burn ratio (dNBR) to classify the burned region in the study area into different fire severity classes that is Low severity, Moderate severity, High Severity and Unburnt Class. The findings indicate that high-severity fires lead to a substantial decline in soil Organic Carbon %, particularly in the topsoil (0–10 cm), due to combustion of organic litter and surface humus, especially in Banj Oak forests, while Chir Pine areas show greater adaptation but also increased invasion of fire-favoring species. Soil nitrogen and phosphorus levels also decrease post-fire, while pH tend to increase. Understanding these impacts is crucial for developing site-specific fire management and ecological restoration strategies in Uttarakhand's sensitive mountain ecosystems. This research contributes to sustainable forest management policies under the growing threat of climate-induced fire frequency and intensity.

Keywords: *Remote sensing; Ecology; Soil Sampling; Fire Severity; Western Himalaya*

Evaluating Agricultural Vulnerability to Climate Change in Punjab, India

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ABSTRACT

India ranks among the most climate-vulnerable countries globally, with Punjab's agriculture increasingly threatened by extreme weather events, groundwater depletion, and unsustainable farming practices. This study assesses the agricultural vulnerability of 23 districts of Punjab through an Agricultural Climatic Vulnerability Index (ACVI), developed using the IPCC framework of exposure, sensitivity, and adaptive capacity. A total of 31 indicators were selected, and Principal Component Analysis (PCA) was used to assign weights. Climatic data were obtained from high-resolution IMD

grids ($0.25^{\circ} \times 0.25^{\circ}$), while socio-economic and agricultural data were sourced from government departments and the Statistical Abstract of Punjab. Principal Component Analysis (PCA) with Varimax rotation was applied to assign objective weights, with final component weights as: Exposure (0.23), Sensitivity (0.36), and Adaptive Capacity (0.41). Districts were classified into low, moderate, and high vulnerability using the Jenks Natural Breaks method. Key drivers of high vulnerability included monocropping, excessive chemical fertilizer use, groundwater over-extraction, low literacy, and over-dependence on agriculture. The findings reveal that SAS Nagar, Hoshiarpur, Rupnagar, and Pathankot are least vulnerable due to better adaptive capacity and diversified agriculture, while Ludhiana, Kapurthala, and Gurdaspur are moderately vulnerable. Ferozepur, Moga, Sangrur, and Faridkot fall into the high vulnerability category, driven by over-reliance on agriculture, monocropping, excessive fertilizer use, and high groundwater extraction. The study recommends strategic shifts such as replacing long-duration paddy with short-duration varieties (PR-126) to reduce groundwater use, adopting AI-based irrigation and tensiometers to optimize water application, increasing canal irrigation system, and promoting crop diversification. The ACVI framework offers a critical tool for guiding district-level climate adaptation and resilience planning in Punjab's agricultural sector.

Keywords: *Agricultural Climatic Vulnerability Index; Principal Component Analysis (PCA); Jenks Natural Breaks method; Groundwater depletion; Canal irrigation system; Crop diversification, Short-duration varieties*

Comparative study of two range-restricted bird species and their response towards Climate Change using Species Distribution Modelling

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ABSTRACT

Climate change, an alarming global phenomenon, is considered a major threat to biodiversity. It is expected to alter the structure, function and composition of the Himalayan ecosystem, which is believed to have an enormously beautiful aggregation of avifaunal species. Some of these are range-restricted bird species that are highly vulnerable to the impacts of climate change due to their narrow ecological niches and limited adaptive capacity. The present study undertakes a comparative assessment of two range-restricted avian species inhabiting the Indian Himalayan Region, a biodiversity hotspot and climate-sensitive ecosystem. Using species distribution modelling (SDM), we evaluated their current habitat suitability and projected future distributions under varying climate change scenarios for late-century (2070) across three Representative Concentration Pathways (RCP 4.5, RCP 6.0, and RCP 8.5). Occurrence records were collated from extensive field surveys and reliable online biodiversity databases, while 30 environmental predictor variables, including bioclimatic, topographic, soil, and vegetation parameters, were used to model potential distributions. Random Forest and Maxent algorithms were applied, and model performance was validated using AUC, TSS, and Kappa statistics to ensure robustness. Results indicated that both species exhibited significant shifts in habitat suitability with increasing greenhouse gas emission scenarios, though the extent and direction of change varied between them. Key environmental predictors included parameters related to temperature, precipitation, elevation and land-use patterns, which collectively influenced the spatial dynamics of both species. The findings underscore the urgent need for targeted conservation planning, emphasizing the protection of potential future refugia and the creation of ecological corridors to facilitate dispersal. This study highlights the importance of comparative SDM approaches in identifying species-specific

vulnerabilities and resilience, thereby guiding adaptive management strategies to mitigate the adverse impacts of climate change on range-restricted Himalayan bird species.

Keywords: *Climate change; Species distribution modelling; Range-restricted species; Random Forest; Maxent; Habitat suitability; Himalayan birds*

Abiotic/biotic stress management under climate change

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ABSTRACT

Abiotic and biotic pressures are being exacerbated by climate change, endangering food and nutritional security and presenting a growing dual challenge to global agriculture. As a result of altering climate patterns, abiotic stresses like drought, salt, severe temperatures, and unpredictable rainfall have increased in frequency and severity. Concurrently, biotic stressors such as diseases, nematodes, insect pests, and weeds are changing in virulence, distribution, and life cycle, which exacerbates crop losses. Since these pressures impact crop quality in addition to output, managing them is crucial for sustainable agriculture. An integrated strategy to stress management is necessary to address these issues. This entails the creation and uptake of crop varieties that are climate resilient, the application of Integrated Pest and Disease Management (IPDM), the use of biotechnological tools (such as genome editing and marker-assisted selection), and the encouragement of sustainable practices like conservation agriculture, crop diversification, and soil health enhancement. Furthermore, real-time pest surveillance, weather forecasts, and ICT-based early warning systems can all greatly enhance readiness and responsiveness. In order to ensure resilient and productive agricultural systems for future generations, this abstract emphasizes the critical need for adaptable, location-specific, and transdisciplinary techniques to control biotic and abiotic pressures in the context of climate change.

Keywords: *Abiotic; Biotic; Climate change; Diseases; Biotechnological tools; Integrated Pest and Disease Management*

Impact of Chromium Stress in Crop Plants in Hindon River Basin of Ghaziabad District, UP, India

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ABSTRACT

Chromium is a heavy metal which exists in many forms and is very toxic and carcinogenic. A severe health crisis has emerged from it in a very concerning way. Lately, due to careless and unchecked industrial depositions along with poor waste management, a lot of chromium has built up in the Hindon river basin. This exposure to chromium has, in turn, polluted much of the food and water sources around this area, posing a lot of health issues. The issue highlights the need for a comprehensive approach that includes scientific research, policy enforcement that prevents bulking of excess chromium waste, healthcare interventions, and community awareness. Studies comparing various polluted river systems in India and abroad show that effective mitigation requires a combination of regulatory oversight, technological innovation, and community involvement.

Several field investigations from the Hindon River have suggested that chromium pollutants, especially in their hexavalent form [Cr(VI)], have severely damaged crops and greenery. Industrial effluents from tanneries, electroplating, and dye industries are the primary sources of this toxic substance's mass existence in such a large amount. Crops that are consumed daily, like wheat, rice, and several others,

often have a really unsafe quantity of chromium in them, which in turn poses a direct threat to food safety. These contaminants degrade plant growth, induce oxidative stress, and result in bioaccumulation in edible plant parts.

The bio-mechanisms by which plants respond to chromium stress involve intricate physiological, biochemical, and molecular processes. Understanding these responses opens innovations for selecting and creating chromium-tolerant crop varieties and implementing strategies such as phytoremediation and soil amendments, and refining agronomic practices to minimize exposure to these toxins.

The findings highlight the urgent need for river basin waste management, environmental monitoring, and agricultural technologies that counter these toxins. Addressing this massive problem soon is crucial for the wellness of everyone. Enhancing environmental awareness and setting up collaborations to resolve this problem will be game-changing. The chromium crisis stands out as an urgent call for action, urging restoration of eco-friendly balance and safeguarding both the crop's and the human's health, providing justice to our upcoming generations.

Keywords: *Chromium Stress; Crop Plants; Hindon River; Ghaziabad*

Assessing Climatic Variability and Crop Yield Linkages in Major Crops of Punjab: A Spatiotemporal Analysis

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ABSTRACT

Punjab, a major agricultural state in India, is facing growing challenges due to climate change. Shifts in temperature, rainfall, and humidity patterns are increasingly affecting crop productivity. This study examines long-term climatic trends (1985–2024) and their impact on the yield of major crops—rice, wheat, maize, cotton—across three agroclimatic zones of Punjab. To analyze these changes, the Mann-Kendall test was used to detect significant trends in climatic variables, and the Sen's Slope estimator was applied to quantify the rate of change. Generalized Additive Models (GAMs) were employed to understand the non-linear responses of crop yields to variations in temperature, rainfall, and relative humidity. The results provide clear evidence of climate change in the region. Minimum temperatures have increased significantly across all zones and seasons, rising by +0.8°C to +2.0°C over the 40-year period. Rainfall during the Kharif season declined sharply in the Sub-mountainous (–274.8 mm) and Central Plain (–109.6 mm) zones. Although total rainfall increased in the South-Western zone, the number of rainy days decreased across all zones, suggesting a shift toward high-intensity rainfall events. Relative humidity also showed a significant increase, contributing to greater pest and disease pressure, especially in rice and cotton systems. These climatic changes are already impacting crop yields and highlight the urgent need for adaptation. The study recommends promoting crop diversification, zone-specific crop planning, expanding MSP coverage to alternative crops, adopting integrated pest management (IPM), and investing in climate-resilient crop varieties. Strengthening farmer awareness and aligning policies with climate trends are essential steps toward sustainable agriculture in Punjab.

Keywords: *Climatic Variability; Crop productivity; Adaptation planning; Climate-resilient agriculture*

Exploring Climate Literacy at the Higher Secondary Level: A Qualitative Case Study from Urban Murshidabad**Samarpan Chakraborty¹, Ritam Dhar², Tamalika Mondal³ and Debabrata Basu⁴**¹*Agril Extension Dhaanyaganga Krishi Vigyan Kendra, Ramakrishna Mission Vivekananda Educational and Research Institute, Murshidabad, West Bengal, India.*²*TDC-NICR), Dhaanyaganga Krishi Vigyan Kendra, Ramakrishna Mission Vivekananda Educational and Research Institute, Murshidabad, West Bengal, India.*³*Sericultural Extension Economics and Management Division, Central Sericultural Research and Training Institute, Berhampore, Murshidabad, West Bengal, India.*⁴*Uttar Banga Krishi Viswavidyalaya, Pundibari, Coochbehar, West Bengal, India.***ABSTRACT**

In the Indian educational context, higher secondary institutions hold a crucial responsibility in cultivating climate consciousness among students before their transition into adulthood. While awareness and climate-related discourse are steadily growing, the integration of environmental and climate change education into the formal curriculum remains fragmented. This study presents a case from the urban areas of Murshidabad district, West Bengal, to explore how sustainability practices and climate literacy efforts both in the syllabus and through co-curricular engagement can empower students to take agency in their everyday lives. Using a qualitative case study approach, data were collected through in-depth interviews with higher secondary students to examine how climate knowledge translates into behaviour and action. The interview transcripts, alongside relevant secondary literature, were analysed using the qualitative data analysis software ATLAS.ti. Thematic analysis was conducted through systematic coding, leading to the development of key themes that reflect students' perceptions, knowledge-action gaps, and opportunities for practical climate engagement. This disconnect highlights the limitations of a curriculum that remains predominantly textbook-driven. The thematic analysis underscored the need for integrating experiential learning opportunities, reflective activities, and participatory decision-making processes within climate education. The thematic analysis of interview transcripts and secondary data revealed a notable gap between students' theoretical understanding of climate change and their ability to apply this knowledge in real-life contexts. However, a few cases emerged where climate literacy initiatives - such as student-led projects, eco-clubs or local sustainability campaigns had successfully imparted awareness and encouraged behavioural change. These instances highlight the potential of experiential learning in shaping students' climate-responsive attitudes and actions. The findings emphasize the importance of embedding such approaches systematically within climate education frameworks to bridge the knowledge-action gap.

Keywords: *Climate Literacy; Experiential Learning; Thematic Analysis; Environmental Education; Student Agency*

Salicylic acid-mediated amelioration of salinity stress in proso millet: insights into morpho-physiological adaptations**Omnia Ashraf Ria¹, Md. Mahabub Alam², Samiul Alam², Md. Sarwar Hosen³, and Mirza Hasanuzzaman²**¹*Department of Agricultural Botany, Faculty of Agriculture, Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka, Bangladesh.*²*Department of Agronomy, Faculty of Agriculture, Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka, Bangladesh.*³*Institute of Seed Technology, Faculty of Agriculture, Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka, Bangladesh.***ABSTRACT**

Soil salinity in agricultural production is increasing, posing significant challenges that disrupt the physiological, biochemical, and molecular processes of plants, ultimately leading to reduced crop quality and yield. This salinity issue particularly impacts cereal crops such as proso millet (*Panicum miliaceum* L.), threatening sustainable production. In this study, the effects of salicylic acid (SA) on mitigating the adverse impacts of salinity on proso millet were investigated. SA, a natural phenolic compound is recognized, for its stress-relief properties. For the experiment, a concentration of 0.5 μ M SA was applied alongside 60, 120, and 180 mM NaCl stress, with SA implemented as a foliar spray and salt introduced through irrigation. Results indicated that salinity-treated plants exhibited reduced in height, fresh weight, and dry weight of both shoots and roots. Furthermore chlorophyll (chl) content and leaf relative water content (RWC) in the leaves also decreased, while Na⁺ ion concentration and electrolyte leakage (EL) increased in salt-stressed plants. Stress indicators such as malondialdehyde (MDA) and H₂O₂ levels were elevated, alongside with increased proline (Pro) content. However, the supplementation of SA enhanced the morphological parameters and curtailed the levels of MDA and H₂O₂. Additionally, potassium (K⁺) ion content increased, while sodium (Na⁺) levels decreased likewise proline content and EL showed improvement in salt-treated plants receiving SA. Overall, SA supplementation led to better yield-contributing parameters, highlighting its potential as an eco-friendly strategy to assuage salinity stress effects on proso millet, suggesting a sustainable approach to crop production.

Keywords: *Oxidative stress; Biostimulants; Ion homeostasis; Salinity; ROS; Osmotic stress***Living Between Hope and Uncertainty: Psychosocial Struggles of Families Raising Children with Intellectual Disabilities****Amna Bakhtawar***Department of Social work, Jamia Millia Islamia University, New Delhi, India.***ABSTRACT**

This paper examines the psychosocial challenges faced by families of children with intellectual disabilities. This involves the daily struggle to support children in emotional and social aspects, where families experience a spectrum of emotions from hope to frustration about their child's development. A review of existing literature will be used to identify main themes such as emotional burden, social isolation, grief, coping strategies, and the role of hope. The analysis will show that while hope is a crucial adaptive mechanism, unmet expectations can lead to emotional exhaustion. The discussion will cover the importance of social support networks, professional counselling, and community resources in mitigating these challenges and propose that more comprehensive support systems are necessary. Recommendations for future research include examining cultural differences in caregiving and the role of resilience in these families.

Keywords: *Intellectual Disabilities; Families; Psychosocial Struggles; Hope; Uncertainty; Parental Coping; Social Support; Emotional Strain*

Implementation of Gaussian Models for Improving Noise Pollution Efficiency In Cognitive Radio Networks

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ABSTRACT

Mobile communication has reduced the amount of spectrum available, but many of these resources are still underutilized. E2SS methodologies for cognitive radio (CR) systems based on machine learning are presented in this paper. Before it can classify, we have to teach the classifier. Unsupervised classification algorithms such as K-means segmentation and the Variational model are used in cooperative spectrum sensing. Mixture designs like Gaussian mixtures, on the other hand, are unable to understand the relationships between data when dealing with large dimensional data. This paper's responsive Gaussian Mixture Model utilizes a mixture of Gaussian distributions to model each data value (AGMM). A Gaussian is a user feature. As the means and standard deviations of each distribution evolve, the algorithm gains a better understanding of the relationships between classes of channels, both available and unavailable. The weight and variance of each distribution are used to determine this. Using the expectation maximising algorithm for reducing dimension data features, this method renews the data group in the feature space. Each classification technique's precision, recollection, F1-measure, categorization error, ROC curve, likelihood of detection, and false detection probability are evaluated.

Keywords: *Noice pollution; Cooperative spectrum sensing; K-means clustering; GMM; Cognitive radio*

Optimizing water productivity in rabi maize through irrigation and nitrogen management strategies

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ABSTRACT

An experiment was carried out during the rabi season of 2022–23 at the Instructional-cum-Research farm, Assam Agricultural University, Jorhat, to examine the effects of different irrigation schedules and nano urea applications on maize yield, water productivity and water use dynamics. The study utilized a split-plot design, with four irrigation regimes—rainfed, irrigation at 0.6 and 0.8 IW/CPE ratios, and irrigation at critical growth stages—assigned to the main plots. Three nitrogen management strategies were tested in the subplots: recommended dose of fertilizers (RDF) with water spray, 50% recommended dose of nitrogen (RDN) combined with 4 ml/L nano urea, and 50% RDN with 6 ml/L nano urea applied at the knee-high and tasseling stages. The findings indicated that irrigation scheduling and rainfall significantly influenced plant growth, yield components, final yield and temporal variations in soil moisture. Weekly average groundwater levels fluctuated in response to rainfall, reaching peaks during intense precipitation events. As a result, differences in moisture extraction depth, crop evapotranspiration, water uptake, and both crop and field-level water use efficiencies were noted across treatments. The highest soil moisture extraction occurred in the upper layers of the soil profile. Among the irrigation treatments, the schedule involving irrigation during the grand growth, tasseling and grain filling stages resulted in the greatest evapotranspiration and total water use, closely followed by the 0.8 IW/CPE ratio. Conversely, rainfed conditions exhibited the highest crop and water use efficiency, followed by the 0.6 IW/CPE treatment. In terms of nitrogen management, nano urea treatments yielded

comparable performance, with the most effective being 50% RDN as basal application along with 6 ml/L nano urea at knee-high and tasseling stages, followed by the treatment using 4 ml/L nano urea.

Keywords: *Evapotranspiration; Groundwater; IW/CPE ratio; Soil moisture; Water use efficiency*

Harnessing Catalysis for Climate Action: Greener Pathways to Carbon Mitigation in Chemical Industries

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ABSTRACT

Decarbonising important industrial sectors is necessary to mitigate climate change, and the chemical industry is essential because of its high greenhouse gas emissions. As a fundamental component of green chemistry, catalysis has the potential to revolutionise chemical processes that are low-carbon, waste-reducing, and energy-efficient. With an emphasis on heterogeneous, biocatalytic, and photocatalytic systems, this study examines the changing field of green catalysis as a tool for climate action. Catalytic processes were evaluated using metrics like energy intensity, CO₂ (Carbon Dioxide) equivalency, atom economy, and lifecycle GHG reductions in a meta-analysis of academic and industrial case studies.

Results show that catalytic substitutes lower carbon emissions by minimising byproduct formation and selective transformations, in addition to reducing energy inputs by 30–60% in important syntheses. In particular, photocatalysis that uses visible light and catalysts that use CO₂ (Carbon Dioxide) has demonstrated great promise in carbon capture and valorisation, providing the twin advantages of pollution reduction and circular material use.

The study focuses on effective industrial uses in agrochemical syntheses, pharmaceutical intermediates, and polymer production. These case studies demonstrate how incorporating cleaner technologies into mainstream production through catalytic green pathways not only lowers emissions but also complies with international climate commitments.

This work suggests a paradigm shift in the way the chemical industry can actively support global climate goals by presenting catalysis as a strategic enabler of climate-resilient chemistry and is extremely relevant for interdisciplinary discussion and policy integration because it crosses the boundaries between chemical innovation and climate science.

Keywords: *Decarbonisation; Greenhouse gas; Green Chemistry; Green catalysis; Climate change; Atom economy; Photocatalytic systems; Valorisation; Agrochemical syntheses; Polymer; Chemical innovation; Climate science*

Entrepreneurship and Innovation for Sustainable Inclusive and Tech Driven Societies

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ABSTRACT

Entrepreneurship and innovation are pivotal forces in shaping sustainable, inclusive, and technology-driven societies. By fostering creative solutions and leveraging advanced technologies, entrepreneurial ventures can address critical global challenges such as climate change, resource scarcity, and social inequality. Sustainable entrepreneurship emphasizes environmental stewardship and the efficient use of resources, while inclusive innovation ensures that marginalized communities have equitable access to economic opportunities and technological advancements. Furthermore, the integration of digital tools, artificial intelligence, and green technologies enhances productivity and supports the development of resilient economies. This paper explores the dynamic interplay between entrepreneurship, innovation, and sustainability, highlighting how policy support, education, and collaborative ecosystems can

accelerate the transition toward a more equitable and technologically empowered world. The findings underscore that fostering entrepreneurial mindsets and innovation-driven strategies is essential to achieving long-term social, economic, and environmental goals.

Keyword: *Entrepreneurship; Innovation; Sustainability; Inclusive Growth; Technology-Driven Societies; Green Technologies; Social Equity; Digital Transformation; Economic Development; Sustainable Development Goals (SDGs)*

Factors Influencing Quality of Life of Migratory Women Workers in Sugarcane Harvesting **Suvarna Maigur and Prema Patil**

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ABSTRACT

A study on quality of life of migratory women workers in sugarcane harvesting was conducted in Bagalkote and Belagavi taluks of Karnataka. The study population comprised of 220 migratory women workers aged between 20 to 50 years selected using a purposive and random sampling method. Tools used for data collection were general information schedule, WHOQOL-BREF scale to assess quality of life, Occupational Health Hazard Scale to measure occupational health hazards and SES scale to measure Socio-Economic Status. The results revealed that majority (78.20%) of the women had moderate quality of life. Regarding SES, 60.50 per cent of women were from upper-middle class and 39.50 per cent were from lower-middle class. Among occupational health hazards, 73.20 per cent of the women were at high-risk followed by medium-risk (26.80 %). Comparison of mean scores revealed that women belonging to 40-50 years age group, illiterate, migrated for more than five months, married and pregnant above 20 years of age, having more than six children, belonging to joint family, having lower-class SES, above 10 family members, experiencing more occupational hazards had poor quality of life. Further, a significant association was observed between duration of migration, age at menarche, age at marriage, family size, occupational health hazards, SES and quality of life. Correspondingly age, education, duration of migration, age at marriage, age at pregnancy, family size, occupational health hazards and SES had a significant effect on quality of life. Subsequently, a significant relationship between duration of migration, age at marriage, occupational health hazards and SES with quality of life was found. Overall the findings underscore the need for targeted interventions, guidance and support programs by the government and sugarcane factory owners. Such initiatives are essential to improve the living standards and quality of life of migratory women workers engaged in sugarcane harvesting.

Keywords: *Migration; Women; Sugarcane; Harvesting; Quality of Life; Occupation; Hazards*

Effect of different modules on incidence of Tuta absoluta and yield of tomato

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ABSTRACT

Experiment was conducted to evaluate the effect of different modules on incidence of Tuta absoluta and yield of tomato at Rajasthan College of Agriculture, Udaipur during rabi, 2023-24. The treatments comprises of BIPM Package, Chemical Control (Spinosad 45 SC @ 1.0ml/ 3 lit) and Untreated Control. During the experimental period, incidence of Tuta absoluta was recorded. No significant difference was observed between BIPM package and chemical control with regard to the parameters viz., leaf infestation (%) and fruit damage (%). BIPM package was equally effective as chemical control against T. absoluta. The leaf infestation in BIPM package was 3.95 % and in chemical control, it was 4.15 %. The highest fruit damage was recorded in untreated control (15.95 %) followed by BIPM package (9.75

%) and Chemical control (9.10%). Chemical control module recorded the highest yield (34.91 t/ha) which was at par with the yield recorded in BIPM package (33.24 t/ha). Significantly, low yield was recorded in untreated control (23.58 t/ha). It could be concluded that BIPM package had promising results in minimizing the pest damage with higher yield.

Keywords: *BIPM; Spinosad; Tuta absoluta*

Social entrepreneurship

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ABSTRACT

Social entrepreneurship is an emerging approach that blends entrepreneurial principles with social objectives to address pressing societal challenges. Unlike traditional business models focused solely on profit, social entrepreneurship prioritizes creating sustainable social impact while maintaining economic viability. Social entrepreneurs identify gaps in areas such as education, healthcare, environment, and community development, and leverage innovative solutions to empower marginalized groups and promote social equity. Through the integration of innovation, collaboration, and resource mobilization, social entrepreneurship contributes to inclusive growth and sustainable development. This paper explores the role of social entrepreneurs as change agents who drive positive transformation by combining business acumen with a mission to solve social problems, thereby fostering resilient and equitable communities.

Keywords: *Social Entrepreneurship; Social Innovation; Sustainable Development; Inclusive Growth; Social Impact; Community Empowerment; Social Enterprises; Change Agents; Social Equity; Economic Sustainability*

Hi-tech Horticulture Food Processing and Value Addition

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ABSTRACT

Hi-tech horticulture, combined with advanced food processing and value addition, plays a crucial role in enhancing agricultural productivity, reducing post-harvest losses, and increasing farmers' income. The integration of modern technologies such as protected cultivation, precision farming, drip irrigation, and sensor-based monitoring systems enables the efficient use of resources while ensuring high-quality produce. Concurrently, food processing technologies, including minimal processing, cold chain management, and innovative packaging, extend shelf life and maintain nutritional value. Value addition through processing, branding, and product diversification creates new market opportunities, catering to consumer demand for safe, nutritious, and convenience-oriented products. This synergy not only promotes sustainability and economic growth but also contributes to food security and rural development. The paper highlights the potential of hi-tech interventions and value-added processing as key drivers for transforming horticulture into a competitive and resilient sector.

Keywords: *Hi-Tech Horticulture; Food Processing; Value Addition; Precision Farming; Protected Cultivation; Post-Harvest Management; Cold Chain; Sustainable Agriculture; Market Competitiveness; Rural Development*

Sustainable Agriculture through Indigenous Knowledge: A pathway to Carbon Neutrality and SDGs**Anindita Saha***Department of Agricultural Extension, Institute of Agriculture (Palli Siksha Bhavana), Visva-Bharati, Sriniketan, Birbhum, West Bengal, India.***Introduction**

Agriculture today faces the dual challenge of **feeding a growing population** while **mitigating and adapting to climate change**. It is a sector highly vulnerable to environmental fluctuations and also one of the largest emitters of greenhouse gases (GHGs), contributing nearly **25% of global emissions**. In this critical context, **Carbon Agriculture** — the strategic management of agricultural practices to **sequester carbon in soil and vegetation** — offers a promising solution.

However, an often-overlooked pillar in this climate-smart approach is **Indigenous Technical Knowledge (ITK)**. ITK refers to **traditional, location-specific, and experience-based knowledge systems** developed by local communities over generations. These knowledge systems are closely tied to nature, are inherently sustainable, and often carbon-friendly — making them ideal contributors to climate mitigation efforts.

This extended summary explores the **intersection of ITK and Carbon Agriculture**, and outlines how their synergy contributes to the achievement of several **Sustainable Development Goals (SDGs)**, particularly in rural and agrarian contexts. It also provides a framework for **mainstreaming and uplifting ITK** within modern agricultural, environmental, and developmental paradigms.

Understanding Carbon Agriculture

Carbon Agriculture is a broad term that refers to a set of **agricultural techniques aimed at increasing the capture and long-term storage of atmospheric carbon dioxide (CO₂)** in the soil and biomass. It focuses on reducing emissions from agriculture (methane, nitrous oxide, CO₂) and enhancing carbon sinks through:

Conservation tillage

Organic farming

Cover cropping

Composting

Crop rotation

Agroforestry

Improved livestock practices

These methods not only reduce the carbon footprint but also enhance soil fertility, water retention, and biodiversity — aligning them with **climate-smart agriculture** principles.

Role of Indigenous Technical Knowledge (ITK) in Carbon Agriculture

ITK represents **generational wisdom of farming communities**, often rooted in ecological harmony, resource efficiency, and community-based innovation. Many of these practices naturally contribute to carbon sequestration and low-emission farming, making them highly relevant to Carbon Agriculture.

1. Soil Organic Carbon Management

ITK-based practices like the application of **farmyard manure (FYM)**, **green manuring**, **biofertilizers**, and **traditional composting** methods (e.g., pit composting, heap composting) add organic matter to soil and promote microbial activity. This not only **enhances soil organic carbon (SOC)** but also reduces the use of synthetic fertilizers, which are major sources of nitrous oxide emissions.

2. Agroforestry and Mixed Farming

Traditional systems like **home gardens**, **alley cropping**, and **multi-tier cropping** involve the integration of trees, shrubs, and crops on the same land. Such systems increase **biomass production** and offer **permanent carbon sinks**, while also promoting food diversity and climate resilience.

For example, the **North-Eastern tribal farming systems** include bamboo, banana, papaya, turmeric, and tubers in a multi-story arrangement, all contributing to year-round carbon fixation.

3. Rainwater Harvesting and Moisture Conservation

Indigenous water conservation methods such as:

Johads and **Khadins** (Rajasthan)

Ahar-Pyne system (Bihar)

Zabo irrigation (Nagaland)

Phad system (Maharashtra)

4. Preservation of Indigenous Crop Varieties

Traditional knowledge has preserved hundreds of **indigenous seed varieties** — often drought-resistant, pest-tolerant, and suited for low-input conditions. These varieties **minimize input-related emissions** (less fertilizer, pesticide, irrigation) and contribute to **resilient food systems**.

For example, tribal farmers in Odisha and Chhattisgarh grow traditional rice varieties like **Kalajeera**, **Sambha Mahsuri**, and **Sali Dhan** that require minimal external inputs and are adapted to extreme climates.

5. Organic and Bio-Based Pest Control

Communities have used **biopesticides** and **natural repellents** made from neem, garlic, turmeric, and ash for centuries. These reduce reliance on synthetic chemicals and prevent the **release of volatile organic compounds (VOCs)** into the environment.

Such practices reduce emissions related to pesticide production, transport, and application — making them integral to low-emission agriculture.

6. Livestock Integration and Waste Utilization

ITK promotes **integrated livestock systems** where animal waste is utilized for:

Organic manures

Biogas generation

Herbal formulations

Such systems reduce methane emissions from unmanaged manure and promote **nutrient recycling**, improving carbon efficiency.

7. Cultural Norms Promoting Conservation

Certain festivals and rituals in tribal and rural communities discourage tree cutting, overgrazing, or hunting during specific periods — indirectly supporting **carbon sequestration** and **biodiversity conservation**.

Challenges in Uplifting ITK

Despite its environmental and cultural value, ITK faces several challenges in being adopted and scaled up in the carbon farming movement:

1. Oral Transmission and Lack of Documentation

Much of ITK remains undocumented and risks being lost with the passing of elder generations.

2. Scientific Neglect

Modern science often disregards ITK due to its **lack of empirical validation** or because it doesn't conform to standard methodologies.

3. Policy Bias

Agricultural policies and subsidies often favor **input-intensive, chemical-based practices**, ignoring low-input traditional practices.

4. Youth Disinterest and Cultural Erosion

Younger generations often perceive traditional practices as outdated, leading to a **loss of knowledge continuity**.

5. Lack of Financial Incentives

Farmers practicing ITK-based carbon farming **don't receive carbon credits** or financial compensation, despite contributing to climate mitigation.

Strategies to Uplift ITK for Carbon Agriculture

To make ITK a central pillar of climate-smart agriculture, the following actions are essential:

1. Documentation and Digitization

Record ITK practices through field surveys, interviews, and participatory methods.

Create **regional ITK databases** and **digital libraries**.

Use ICT tools and mobile applications to promote knowledge sharing.

2. Scientific Validation and Customization

Conduct **field trials and lab tests** to validate ITK practices.

Collaborate with **agricultural universities and KVKs** to optimize and scale up validated practices.

3. Policy Mainstreaming

Integrate ITK into **national carbon farming policies**, such as:

National Mission for Sustainable Agriculture (NMSA)

Paramparagat Krishi Vikas Yojana (PKVY)

Recognize ITK under **carbon credit** and **ecosystem service schemes**.

4. Education and Extension

Include ITK in formal **agricultural education curricula**.

Conduct **training programs and farmer exchange visits**.

Use **farmer-to-farmer extension models** to spread knowledge organically.

5. Carbon Credit Integration

Develop farmer-friendly **Monitoring, Reporting, Verification (MRV)** tools.

Allow traditional practices like **agroforestry, composting, mulching** to qualify under **voluntary carbon markets**.

Ensure **benefit sharing** mechanisms for smallholders and tribal communities.

6. Public-Private-People Partnerships (PPPP)

NGOs can document and promote ITK.

Start-ups can **innovate ITK-based organic products**.

Government agencies can ensure **policy and financial support**.

Alignment with Sustainable Development Goals (SDGs)

The **SDGs provide a global framework** for development that is **socially inclusive, economically viable, and environmentally sound**. **ITK and carbon agriculture** intersect with several SDGs:

SDG	Contribution of ITK-based Carbon Farming
SDG: Zero Hunger	Sustainable food systems through soil health and low-input farming
SDG : Responsible Consumption	Eco-friendly production and waste recycling
SDG : Climate Action	Carbon sequestration and reduced GHG emissions
SDG : Life on Land	Biodiversity conservation and land restoration
SDG : Clean Water	Efficient use and conservation of water resources
SDG : Reduced Inequalities	Empowering tribal and marginalized communities
SDG : Partnerships for the Goals	Multi-stakeholder efforts in ITK promotion

Conclusion

Indigenous Technical Knowledge (ITK) is more than folklore — it is a climate solution rooted in ecology, culture, and resilience.

As the world races to achieve net-zero emissions and sustainable agriculture, ITK offers **affordable, accessible, and adaptable pathways** to carbon farming. These practices are not just environmentally sustainable but **socially just and culturally meaningful**.

The upliftment of ITK is not just about preserving tradition — it is about **empowering communities, healing ecosystems, and redefining modern agriculture** in harmony with nature.

Through scientific support, policy recognition, community participation, and global alignment with SDGs, we can ensure that **ITK becomes a cornerstone of carbon agriculture**, leading us toward a greener and fairer world.

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Policy, Support System and Infrastructure

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ABSTRACT

A robust policy support system and well-developed infrastructure are fundamental to driving economic growth, social development, and technological advancement. Effective policies provide a strategic framework for resource allocation, regulatory reforms, and the promotion of innovation, while supportive infrastructure ensures the seamless functioning of industries, agriculture, and services. The synergy between policy interventions and infrastructure development enhances productivity, reduces regional disparities, and fosters an enabling environment for entrepreneurship and investment. Moreover, the integration of digital infrastructure and sustainable policy measures accelerates progress toward achieving the Sustainable Development Goals (SDGs). This paper discusses the critical role of policy support systems and infrastructure in building resilient economies, improving service delivery, and creating opportunities for inclusive and technology-driven development.

Keywords: *Policy Framework; Support System; Infrastructure Development; Economic Growth; Sustainable Development; Governance; Digital Infrastructure; Public-Private Partnership; Innovation Ecosystem; Inclusive Development*

Impact of Contaminated Water on Public Health and Ecosystems

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ABSTRACT

Water contamination is a critical global concern with profound implications for public health and environmental sustainability. This study explores the various sources, types, and impacts of contaminated water on human populations and ecosystems. Contaminants such as pathogenic microorganisms, heavy metals, agricultural chemicals, and industrial effluents enter water bodies through domestic sewage, industrial discharge, and agricultural runoff. Their presence in drinking and surface water sources leads to significant health risks, including acute illnesses like cholera and typhoid,

as well as chronic conditions such as cancer and neurological disorders due to long-term exposure to toxic elements like arsenic and lead.

Beyond human health, contaminated water severely disrupts aquatic ecosystems. Nutrient pollution accelerates eutrophication, resulting in oxygen-depleted dead zones that threaten aquatic biodiversity. Toxic pollutants accumulate in the food chain through bioaccumulation and biomagnification, affecting species survival and ecosystem stability. Additionally, the economic consequences ranging from healthcare costs to losses in agriculture, fisheries, and tourism underscore the need for urgent intervention.

The paper emphasizes the necessity of integrated water resource management, improved wastewater treatment infrastructure, stricter regulatory frameworks, and increased public awareness to mitigate water contamination. Protecting water quality is not only essential for safeguarding public health but also for preserving the ecological integrity and socioeconomic stability of communities worldwide.

Keywords: *Contamination; Environmental Sustainability; Industrial Discharge; Bioaccumulation*

Applications of Smart Textiles in different Field

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ABSTRACT

Textiles with embedded electronics and linkages that provide physical flexibility not possible with any known electronic manufacturing techniques are sometimes referred to as smart textiles. Smart textiles, which are increasingly popular, are an important tool for tracking our health throughout our lives. They can also be used to capture energy from the environment or the human body. In addition to being less likely to become tangled by nearby objects because they are intrinsic to the fabric, interconnections and components can more readily adjust to rapid changes in the computational and sensing needs of any given application, which is helpful for context awareness and power management.

Electronic systems must adhere to wear ability norms in order to be included into our everyday clothing, according to the wearable technology concept. What distinguishes wearable systems is their capacity to automatically identify the wearer's activity and behavioral state as well as that of their surroundings and utilize this information to adjust the system's configuration and functionality. This article focused on recent developments in the field of smart fabrics, paying particular attention to the materials and production methods and different field in which its used i.e. health care and wellness, sports and fitness, fashion and style, safety and protection, military and defense and automotive and transportation.

Keywords: *Smart textiles; Fabrics; Clothing; Wearability; Fashion*

Post-harvest Technologies and Mechanization for Profitability

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ABSTRACT

Post-harvest technologies and mechanization are critical components in enhancing the profitability and sustainability of agricultural production systems. Efficient post-harvest handling, including grading, sorting, packaging, and storage, minimizes losses, preserves quality, and extends the shelf life of produce. The adoption of mechanized solutions such as automated harvesters, conveyors, and advanced packaging equipment reduces labor costs, increases operational efficiency, and ensures uniform product standards. Furthermore, the integration of cold chain logistics, controlled atmosphere storage, and digital monitoring systems improves market access and competitiveness. These advancements not only add value to agricultural commodities but also empower farmers and agribusinesses to meet the growing

demands of domestic and international markets. This paper emphasizes that investing in post-harvest technologies and mechanization is essential for achieving higher profitability, reducing food waste, and promoting a resilient agricultural sector.

Keywords: *Mechanization; Profitability; Food Loss Reduction; Cold Chain; Value Addition; Storage Technologies; Agricultural Efficiency; Sustainable Agriculture*

Advances in Pest Management

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ABSTRACT

Diseases and pests affect crop yield and quality while decreasing the effectiveness of resource usage. Enhancing crop protection techniques to stop such loss and damage may increase production and significantly improve food security. The speed, sensitivity, and accuracy of pathogen and pest detection and diagnosis are probably going to be significantly improved by DNA-based technology. Identification of new disease agents will be aided by the quick sequencing of nucleic acids from affected plants. Pest outbreaks can also be identified by biomarkers of illness or crop damage, such as volatile compounds or mixes.

Biosensors connected to information networks will enable real-time crop or stored produce monitoring and surveillance, resulting in early detection of new invasive species and new problems. The explosive growth of the internet, mobile phones, and other communication networks will present new opportunities, but there are still ssobstacles in the way of distributing new technologies and information to resource poor farmers in emerging nations. A significant advancement in plant biology has been the identification of the genetic and molecular foundations of innate plant immunity, which may lead to the discovery of new targets for intervention through genetic modification (GM) or novel chemicals.

Keywords: *Diseases; Pests; Crop protection; DNA-based technology; Decision-making Surveillance*

Estimation of genetic variability and response to selection in fennel (*Foeniculum vulgare* Mill.)

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ABSTRACT

Understanding genetic variability is crucial for the genetic improvement of crops, particularly in the context of developing climate-resilient varieties. A field experiment was conducted during the Rabi season of 2020–2021 at the Vegetable Research Farm, ANDUA&T, Narendra Nagar (Kumarganj), Ayodhya, India, to assess the extent of genetic variation and selection potential among 78 fennel (*Foeniculum vulgare* Mill.) germplasms along with three checks using Augmented Block Design. Analysis of variance revealed highly significant differences for all twelve traits studied. High genotypic and phenotypic coefficients of variation (>20%) were observed for internodal length and number of nodes per plant, indicating substantial variability. Broad-sense heritability was high (>75%) for all traits, suggesting a strong genetic influence. Notably, traits such as internodal length, number of nodes per plant, number of seeds per umbellet, seed weight per umbel, number of umbels per umbel, number of branches per plant, and test weight showed both high heritability and high genetic advance as a percentage of mean. This implies the predominance of additive gene action, making these traits highly responsive to selection in breeding programs. These results offer valuable insights for breeders aiming

to enhance seed yield and its contributing traits in fennel, supporting the development of high-yielding, stress-resilient varieties for future cropping systems.

Keywords: *Augmented block design; Climate-resilient crops; Genetic advance; Genetic variability; Heritability; Selection response; Yield components*

Dyeing of unconventional Lotus (*Nelumbo Nucifera Gaertn.*) fibers with Natural dyes

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Purpose

Coloration is an important part of textile leading to aesthetics and popularity. Nature has gifted many color yielding sources from plants and animals. Though natural dyed products are not marketed in the huge amount due the issues related to longer time needed for extraction, high usage of energy and improper fixation of color into the fabric. Till date, Indian handloom weavers and printers practice the art of natural dyeing. The newer minor cellulosic fibers and natural dyes are preferred by specified niche consumers. Hence Lotus dyed yarns were experimented with few known natural dyes and further its fastness properties were also assessed.

Materials and Methods

Waste Lotus petioles after plucking flowers were procured from the Local Lotus cultivators of Vadodara district of Gujarat. Fibers were extracted manually and 100 % Lotus yarn were spun on *Ambar charkha*. Before dyeing, yarns were scoured and experimented for dyeing using eight different natural dyes mentioned in (Table – 1).

Table 1. Sources of natural dyes

Sr.No	Dye Source	Botanical names of the dye source	Obtained as
1	Marigold	<i>Tagetes erecta</i> L.	Flower Petals
2	Madder	<i>Rubia tinctorum</i> .	Powdered form
3	Lac	<i>Kerria Lacca</i> .	Crystal form
4	Sappan Wood	<i>Caesalpinia sappan</i> L.	Powdered form
5	Katho	<i>Acacia Catechu</i> .	Powdered form
6	Indian Berries	<i>Anamirta cocculus</i> .	Powdered form
7	Annato	<i>Bixa orellana</i> .	Powdered form
8	Pomegranate rind	<i>Punica granatum</i> .	Dry form
9	Natural Indigo	<i>Indigofera tinctoria</i> .	Indigo cake

Dyeing procedure

Aqueous extraction method was used. Before dyeing, Lotus yarns were pre-mordanted using Alum. Dyeing was done in an open bath in 4 % shade. Self pH was used.

	M:L Ratio	Temperature (Celsius)	Time (in minutes)
Extraction of dyes	1:40	60°C	30
Pre-Mordanting	1:30	Room temperature	30
Dyeing	1:40	60°C	45

Results and Discussions

Color strength

L* value of all the dyed samples was high that were in the range of 63-79, except Indigo (LNI). Lotus yarn dyed with Indigo has a lower L* value of 30.055, which is more towards the darker side. Lotus yarn dyed with Sappan wood (LNS) and Madder (LNM) has a high a* value that is 18.339 and 15.314 respectively means these dyed samples were more towards redder side. Samples dyed with Marigold (LNMG): 0.392, Katho (LNK):1.889, Lac (LNL): 2.990, Pomegranate rind (LNP) :7.605 and Indian berries (LNIB) : 9.583 has achieved low a* value means these dyed samples was less red. Lotus yarns dyed with Indian Berries (LNIB) has a high b* value that is 14.966 followed by Marigold (LNMG): 13.500 and Pomegranate (LNP): 12.178.

Lotus yarn dyed with Indian berries has achieved a lighter and bright yellow color, marigold has obtained darker yellow color and pomegranate was towards yellowish brown color. Samples dyed with Marigold (LNMG) and Madder (LNM) was bright and brilliant with the higher C* value of 18.91 and 18.03. Lotus yarns dyed with Indian Berries (LNIB) has obtained lower C* value that is 10.172. Lotus yarn dyed with Indigo dye has obtained negative a* value that is -7.577 which is more towards greener side in the color axis and the b* value was also negative that is -14.807 which is more towards blue color. The K/S value of Lotus yarn dyed with Indigo dyes (LNI) was higher that is 89.58 amongst all the dyed samples means the absorption of this dye was more. Lotus yarn dyed with Katho (LNK) has obtained lower K/S value of 2.109 from all the dyed samples.

Fastness property of Lotus yarn dyed with natural dyes

Lotus yarn dyed with Katho (LNK), Madder (LNM), Marigold (LNMG), Indian berries (LNIB), Sappan Wood (LNS) and Lac (LNL) has obtained very good to excellent light fastness property. Lotus yarns dyed with Indigo dyes (LNI) has obtained fair light fastness property. Lotus yarn dyed with Indigo dyes that is (LNID) and (LNIL) has obtained very good to excellent washing fastness property with the rating 4/5. Indigo dyeing has its prestigious place in Indian traditional textiles from the ancient times in India. Thus, this will be a novel fiber in the Indigo dyed textiles. Lotus yarns dyed with Lac (LNL)-3, Katho (LNK)-4, Sappan Wood (LNS)-3, Madder (LNM)-3/4, Marigold flower petals (LNMG)-3, Indian Berries (LNIB)-3 has obtained good to very good washing fastness property which may be due to the pre-mordanting with Alum and Lotus fiber inherent property of water absorbency and fine microfiber structure.



Conclusions

The Lotus yarns dyed with natural dyes has obtained very good to excellent light and washing fastness property. The color strength K/S value of Lotus yarn dyed with Indigo dyes was high that is 89.58 amongst all the natural dyes means the absorption of the Indigo dyes was more into the Lotus fiber. Due to the inherent properties of the Lotus fibers like high water absorbency and microfiber structure it has a good dyeability properties.

Keywords: Lotus, Petiole, Natural dyes, Yarn

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Adoption and Constraints Faced by Farmers in Cultivation of Oilseed Crops in Raigad District of Maharashtra

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ABSTRACT

The population is increasing, the demand for agricultural produce is increasing rapidly and the scope of bringing more land under cultivation is receding fast. Thus, increasing production per unit of available land is the only answer to the problem. Therefore, the Indian Council of Agricultural Research (ICAR), in order to boost the production and productivity by using the latest technologies introduced the concept of Front-Line Demonstrations (FLDs). In order to bring production to the forefront and to achieve even higher level of production, FLDs play the most pivotal role in terms of providing viable technological inputs. These demonstrations will also provide scientists with an opportunity to demonstrate the technology under actual farmer's conditions and get direct feedback from the field so that the performance of the new technology could be further modified and improved. Oilseeds form the second largest agricultural commodity in India after cereals sharing 15.5 % of gross cropped area and accounting for nearly 3.6 % of the gross National product and 10.4% of value of all agricultural products. The study revealed that the possible reason behind big farmer's adoption level to medium extent might be due to medium level of scientific orientation and risk bearing ability. Low adoption level was found in small farmer's category (45.68 per cent) as compared to medium and big farmer's category. In the practices like, recommended improved/hybrid variety, FYM application, fertilizer application, intercultural operations and weed/water management, the demonstrator farmers had more adoption level. Frequency of constraints related to technological and extension category was relatively

less as compared to other constraints like availability of inputs and financial. Emphasis should be given on conduct of off campus training and field demonstrations on recommended agricultural technologies. Still there is a need for greater attention on the part of officials involved at the grass root levels and need to strengthen the staffing pattern and infrastructures of various technology transfer organizations.

Keywords: Front-Line Demonstrations, Adoption, constraints, oilseeds

Present States, prospects and Challenges for Food Security in South Asia

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Overview

South Asia, despite its rich agrarian history and vast natural resources, faces a paradox of **agricultural abundance alongside chronic food insecurity and growing water stress**. Agriculture consumes more than **80% of the region's freshwater**, and yet much of it is lost due to inefficient irrigation, outdated farming practices, and lack of integrated water management. The region houses **nearly a quarter of the world's population**, but has only a **fraction of the world's freshwater resources**.

Present Status

Agriculture remains the primary livelihood for a majority of South Asia's population.

The region is a major producer of **rice, wheat, pulses, fruits, and vegetables**.

Despite self-sufficiency in food production at the national level, **pockets of acute hunger and malnutrition** persist.

Water tables are **declining alarmingly**, especially in **India, Pakistan, and Bangladesh**, due to over-extraction and climate-induced stress.

Prospects

There is significant potential for growth through **technology-driven agriculture, efficient water use, and regional cooperation**.

Innovations in **precision farming, drip irrigation, and AI-based crop monitoring** offer scalable solutions.

Regional initiatives to share **weather data, seed technology, and disaster risk management strategies** can strengthen resilience.

Challenges

Climate change, through rising temperatures and erratic rainfall, is increasing uncertainty.

Cross-border water disputes and weak water governance hamper equitable water sharing.

Smallholder farmers, who form the bulk of the agricultural workforce, often lack access to **credit, infrastructure, and insurance**.

Nutritional insecurity, including **hidden hunger**, remains prevalent due to dietary imbalances and lack of food diversity.

1. Introduction: South Asia's Agricultural Landscape

South Asia is home to more than 1.9 billion people and encompasses some of the most fertile agricultural lands in the world. Agriculture remains the backbone of the region's economy, employing more than 40% of the workforce and contributing significantly to GDP in several countries. However, despite high agricultural potential, the region faces persistent and multi-dimensional challenges in ensuring food and nutritional security for its growing population.

The speaker began by setting the stage: South Asia, while rich in agricultural biodiversity and cultural farming practices, continues to be one of the most food-insecure regions globally. According to the Food and Agriculture Organization (FAO), in 2024 the prevalence of undernourishment (PoU) in Asia fell to 6.7%, still accounting for 323 million undernourished people—of which a significant portion reside in South Asia. One-third of the world's poor and many of the world's undernourished live here.

2. Key Challenges in the Region

There are several pressing challenges confronting South Asia's agri-food systems:

a. Food Insecurity and Malnutrition

Despite high food production, significant sections of the population remain undernourished or malnourished.

Hidden hunger (micronutrient deficiencies) coexists with overnutrition and obesity, especially in urban areas.

b. Climate Change and Environmental Degradation

Rising temperatures, erratic monsoons, frequent droughts and floods, and glacier melting in the Himalayas are severely affecting agricultural yields.

Crops like wheat, rice, and maize are most at risk, with projected yield reductions of 10–30% by 2050 if no adaptation measures are taken.

c. Water and Soil Resource Depletion

Overextraction of groundwater, especially in India and Pakistan, has led to a sharp decline in water tables.

Soil degradation due to chemical inputs, monocropping, and residue burning continues to lower long-term productivity.

d. Socioeconomic and Market Challenges

Persistent poverty and inequality, outmigration of labor, poor infrastructure, and limited market access impede inclusive agricultural growth.

Fragmented landholdings and lack of access to credit and technology further constrain smallholder farmers.

e. Trade and Policy Barriers

Restrictive trade policies, export bans, and tariff barriers often exacerbate food price volatility and food availability across borders.

3. Nepal's Contributions and Innovations

As the host nation, Nepal was commended for its resilient approach to agricultural sustainability:

Climate-Resilient Farming: Nepal has actively promoted climate-smart agricultural practices in its mountainous and hilly regions. This includes the use of bio-fertilizers, terracing, and mixed cropping.

Community-Based Solutions: The speaker noted Nepal's successful models of community irrigation systems, seed banks, and farmer cooperatives, especially in remote areas.

Organic and Ecological Farming: Nepal's emphasis on low-input, traditional farming practices offers a pathway for sustainability in fragile ecosystems.

Policy Integration: National strategies such as the Agricultural Development Strategy (ADS) and the Right to Food and Food Sovereignty Act 2018 were highlighted as significant steps toward institutionalizing food security.

The speaker emphasized that despite challenges like terrain, infrastructure, and climate vulnerability, Nepal's innovative and community-driven solutions make it a valuable case study for other South Asian nations.

4. India's Role in Strengthening Regional Food Security

As the largest economy and food producer in South Asia, India's actions have far-reaching impacts on the regional agri-food landscape. The speaker outlined four key areas of India's contribution:

1. Promoting Research, Education, and Technology Sharing

Collaborative R&D: India works with neighboring countries on seed development, crop resilience, livestock health, and pest control.

Scholarships and Training: India offers fully funded scholarships to students from BIMSTEC countries, including Nepal, for higher studies in agriculture.

Centers of Excellence: India has proposed setting up a BIMSTEC Centre of Excellence for Agriculture Cooperation to disseminate advanced technologies like AI, drones, and climate forecasting.

2. Facilitating Regional Trade and Integration

SAFTA Participation: India is a key participant in the South Asian Free Trade Agreement (SAFTA), which helps reduce trade barriers in agriculture.

Addressing Non-Tariff Barriers: India is working toward easing trade constraints that impact the movement of agricultural goods and technologies within South Asia.

SAFANSI Partnership: Through the South Asia Food and Nutrition Security Initiative, India contributes to multi-country programs targeting nutrition, women's empowerment, and child health.

3. Humanitarian and Development Assistance

Food Aid: India has supplied food grain to countries like Afghanistan and Sri Lanka during humanitarian crises, often in collaboration with the World Food Programme.

Disaster Relief: India provides emergency aid, medical supplies, and food in the aftermath of natural disasters in neighboring countries.

Development Projects: India invests in cross-border rural development, agricultural infrastructure, irrigation systems, and education.

4. Domestic Programs as Regional Models

National Food Security Act (NFSA): Covering over 800 million citizens, India's NFSA and Public Distribution System (PDS) offer a replicable model for food security.

Nutrition Missions: Initiatives such as POSHAN Abhiyaan, food fortification, and midday meal schemes have reduced malnutrition rates in recent years.

The speaker emphasized that these initiatives reflect India's commitment to sharing resources, experience, and innovations with its neighbors to ensure a food-secure South Asia.

5. Policy Directions and Regional Cooperation Opportunities

The speaker concluded by outlining critical strategies needed to ensure future food security in the region:

Climate-Smart Agriculture: Scaling up adaptive technologies and climate-resilient infrastructure.

Efficient Water Management: Implementing drip irrigation, rainwater harvesting, and reducing groundwater overuse.

Technology Access: Promoting access to ICT tools, crop monitoring systems, and precision agriculture.

Market and Credit Access: Enhancing rural credit systems and eliminating market entry barriers for smallholders.

Trade Openness: Encouraging regional trade by reducing tariff and non-tariff barriers.

Nutrition-Focused Programs: Targeting malnutrition with food fortification, school feeding, and women/child-focused programs.

Farmer Empowerment: Strengthening extension services, farmer producer organizations, and agri-entrepreneurship.

Data and Research: Investing in real-time data systems, early warning mechanisms, and regional foresight studies.

6. Conclusion: Toward a Food-Secure and Water-Secure South Asia

In closing, it is clear that **agriculture, food security, and water resources are deeply interconnected**. South Asia's ability to **feed its people**, sustain its **natural ecosystems**, and adapt to **climate change** depends on how effectively it addresses these sectors together—not in isolation.

Water is not just a resource; it is the **lifeline of food systems**, and its mismanagement threatens all progress. Similarly, ensuring **nutritious and adequate food** is not just about growing more crops—it's about managing land, water, people, and markets in harmony.

As highlighted in this lecture:

Nepal showcases the power of **community-driven, ecologically sensitive solutions**, even under geographic and infrastructural constraints.

India, with its research capacity and regional leadership, offers scalable models and a strong foundation for regional cooperation.

“Today and for generations to come, we can guarantee that every South Asian citizen not only has enough food to eat but also has access to safe, nourishing, and sustainable food by working together with common goals and a cooperative spirit.”

This vision requires:

Shared knowledge and technology

Mutual respect for transboundary resources

Political will to act together

Only through a **unified and inclusive approach** can we move toward a **resilient, equitable, and food- and water-secure South Asia**.

Keywords: Food Security, Climate Change, Sustainability, Trade, Poverty, Starvation

Socio- economic potential and Cultural significance of Badri- Tulsi (*Origanum vulgare* L.): A case study of Uttarakhand, India

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ABSTRACT

Origanum vulgare L., locally known as Badri- Tulsi, is a highly valued aromatic and medicinal herb native to the Himalayan region, particularly Uttarakhand, India. This case study explores the socio-economic potential and cultural significance of Badri Tulsi among local communities in district Chamoli, Uttarakhand. Through ethnobotanical surveys, key stakeholder interviews, and market analysis, the study reveals that Badri- Tulsi holds deep cultural reverence and plays a crucial role in traditional medicine, religious practices, and local livelihoods. Its therapeutic uses, including treatment of respiratory, digestive, and inflammatory ailments, are well integrated into indigenous healthcare systems. Culturally, the garland made of Badri-Tulsi has been an integral part of rituals at Lord Badrinath Temple and therefore, economically, offers substantial livelihood opportunities to local communities (Bhotiya tribes and others) through wild collection, garland making, marketing, small-scale cultivation, and other value-added products such as essential oils and herbal teas. Crucially, the study identifies the pivotal role of women in the entire value chain from wild collection and primary processing to product development and local marketing. However, unregulated harvesting, limited market access, and lack of value-chain development pose challenges to its sustainable utilization. The study emphasizes the need for policy support, capacity building, and community-based conservation to enhance the socio-economic benefits of Badri Tulsi while safeguarding its ecological and cultural heritage.

Keywords: *Badri-Tulsi, Socio-economic, Cultural significance, Livelihood, Medicinal, Aromatic, Ethnobotany.*

Climate Change and its Impact on Large Cardamom (*Amomum Subulatum* Roxb.) Cultivation in West District of Sikkim**Deepa Rai***Department of Geography, Kumaon University, Nainital, Uttarakhand***ABSTRACT**

Large cardamom is an indispensable cash crop of Sikkim and native to the state. It plays vital role in upliftment of rural economy and support livelihood. However, climate change poses significant threats to its cultivation, altering temperature, rainfall, and phenological cycles. This study assesses the impact of climate change on large cardamom cultivation in West Sikkim, and understand the farmer observation and perception regarding climate change issues. Total of 104 household surveyed included from six study site where stratified random sampling techniques were employed to selects the sites, where main focus was tried to find out weather related events over their areas such as increase/ decrease in temperature, changes in rainfall pattern, observed abnormalities in weather phenomena like prolong dry spells, occurrence of flash floods, snowfall timing, hailstorm regularities, spring/ rivers volume and velocity of water, abnormalities in biological changes in large cardamom, diseases and pest attacks, and alteration in crop attributes. Farmers and few key selective interviews with large cardamom experts has taken up to in-depth understanding of key problems pertaining to crop farming. Results indicates that maximum farmers percept and observed on increase in annual temperature, pervasive drought condition, incessant rainfall pattern and other extreme weather events which have immense impacts on large cardamom cultivation, encouragements of incidence of viral and fungal diseases which presently became the severe enemies of farmers because none farmers are on safe zone. Endemic crop varieties gone drastic reduction or decrease because of unproductivity and severely attacked by diseases and pest, became victim of severity of weather events around study areas. As per the farmers observation and perception drastic decline in cultivation and production credited to abnormalities in weather phenomena of areas. The change is directly impacted on household economy because large cardamom is a prime cash crop of farmers exacerbating the income of rural household. The immediate action and integrated assessment on large cardamom status and present condition is crucial, needs to address the currents issue of diseases and pest control, farm management, institutional help to increase other production and cultivation of cash crop to revive the originality of large cardamom to uplift the marginal farmers in rural areas of west Sikkim.

Keywords: Large Cardamom, Climate Change Impacts, West Sikkim, Crop Vulnerability, Farmers Observation and Perception.

A Study on Awareness and Practices of Solid Waste Management Among School Children**Sarika Patel* and Chandrikkumar Rajdeep***Department of Extension and Communication, The Maharaja Sayajirao University of Baroda, Vadodara, Gujarat. (390002)***ABSTRACT**

Solid Waste Management is not just a process; it is an ideology. It builds an attitude towards environment conservation and sustainable environment practices. It is also a collective responsibility of all individuals, families and institutions involved be it governmental, non-governmental or educational. Shouldering of accountability does not only remain with adults as school children can be a good cadre if they are given proper education, training and skill building education to strengthen the ideology of solid waste management. In this regard teaching and training solid waste management at schools is a game changer for sustainable environment practices. It helps in environment protection, cleanliness, preserving health and hygiene and creating good practices at school and homes. The present study was

conducted with the objectives of assessing existing knowledge and practices of solid waste management among school children, developing and executing an educational intervention and evaluating its effectiveness among the primary school children. These school children have been given exposure about basics of various components related to social waste management like environment protection, pollution and its impact, waste collection and disposal system, composting of kitchen waste, reuse, recycle and reduce for environment protection and contribution of students to make school and home waste friendly. With survey and intervention, the pre and post data were compared to find out the effectiveness. The prominent findings of the data highlight the improved knowledge and practices about solid waste management. It also shows how increased awareness has helped these children to practice reduce, reuse and recycle in their daily life at schools and at home. Such development of sustainable habits and behaviour is a result of planned educational interventions with core focus on management of solid waste for holistic environment protection. This result will enable all the stakeholders to design policy educational initiatives for preparing a cadre of empowered change agents.

Key words: Solid Waste Management, Sustainable Environment Practices, School Children

A Systematic Study of Work-Related Musculoskeletal Disorders Among Floor-Sitting Handicraft Workers

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ABSTRACT

Purpose: Handicraft manufacturing is one of the occupations where work-related musculoskeletal disorders (WMSDs) pose a significant risk to workers. Due to the multifactorial causes and the varying occurrence of WMSDs across different body regions, this study aimed to assess the prevalence of WMSDs and identify related risk factors among handicraft workers who perform their tasks in a floor-sitting posture.

Materials and Methods: This review was conducted using literature sourced from one electronic database. The retrieved articles were screened based on predefined inclusion and exclusion criteria. After applying these selection criteria to eight articles, six were deemed relevant and analyzed in depth.

Results: The findings suggests that the prevalence of musculoskeletal symptoms among handicraft workers ranges between 12%-90%, and the most affected body areas were the shoulder, neck, and upper back. Risk factors including working posture, daily working hours, repetitive and forceful movements and working under stressful conditions were found to be highly associated with the occurrence of WMSDs.

Conclusion: The handicraft workers are at high risk of developing WMSDs. Further research, preferably longitudinal studies, with more emphasis on work-related factors should now be undertaken to thoroughly investigate WMSDs in this occupational group.

Keywords: Ergonomics, Risk factor, Unorganized sector

Milkweed: Sustainable future of textiles**Madhu Sharan¹ and Sumi Sharma²**¹*Department of Clothing and Textiles, Faculty of Family and Community Sciences, The Maharaja Sayajirao University of Baroda, Vadodara, India*²*Department of Fashion Designing, School of Vocational Studies Vanita Vishram Women's University, Surat, India***Purpose**

Agriculture is the cornerstone of the Indian's economy. Natural fibers from plant origin are the backbone of the textile and fashion industry. Newer natural fibers play an important role in sustainable environmentally friendly future. Fiber said to "sustainable" depend on many factors: its user-friendly collection from farm, pesticides and water used in that particular farm, sustainable method of extraction, sustainable method of treatment, benefits to the farmer community, yield of the fiber per hectare, the shelf life of the particular plant and cost of the developed product from fiber. Moving towards the path of sustainability, Milkweed is a newer promising fiber in the area of textiles. The research review provides the comprehensive data of the Milkweed fiber which includes: morphology of the Milkweed plant, availability of Milkweed fiber in India, Properties, characteristics, chemical composition, extraction methods, its application in the areas of textiles and government initiatives undertaken for milkweed fiber.

Methods

The secondary data has been collected from different national and international research papers, books, articles, and interactions from different researchers working in similar fields.

Major findings**Morphology of plant**

These are perennial plants. Its leaves are dark green and waxy placed opposite to each other with a prominent, white mid-vein and pointed tips. They spread more robustly by the sprouts from underground roots than seeds [1]. They bear five-petal flowers in the shades of orange, red, purple, yellow or pale white and pod-like fruits with tufted seeds. These seeds, aligned in overlapping rows, have white, silky hairs known as coma, floss or silk. When the follicles mature, the pods burst open, releasing seeds with fibrous wings to be carried around by the wind. Milkweed plants produce a milky substance when their plant cells are damaged [2].

In the case of Indian milkweed, the plant yields seedpods up to 10 years, after 2 to 3 years of planting, with higher yields between 4 to 8 years of age. Floss can be harvested 6 to 7 times in the lifetime of a plant with 100 to 140 gm. of floss per harvest. A single plant usually bears 1 to 7 seedpods in each season. As the dry weight of floss per fruit is about 0.8 gm., 1265 follicles will be needed to gather 1 kg of fiber [3].

Areas of cultivation

It is grown in the tropical regions and in the drier parts of Central and South America. In India, it grows widely on barren and wastelands in Punjab, Uttar Pradesh, Tamilnadu, Andhra Pradesh and Rajasthan [4].

Milkweed fibre (*Asclepiad syriaca*.) is obtained from the seedpod of milkweed plant, which is called as mudar. The stem also consists of the fibrous material. The entire plant consist of milk saps from it leaves and stems. The sap from the stem has numerous medicinal properties especially for healing pain, asthma, bronchitis, dyspepsia, leprosy, tumor, and some other gastro intestinal diseases [5].

Fiber properties

It is a single cell fiber like a Cotton but it doesnot consist of convolutions. According to the microscopical study, milkweed has a hollow structure [6]. Due to the hollow structure and low density, it has a good insulation and moisture management properties [7]. According to the chemical

composition, it contains high amount of lignin and hemicellulose [8]. It has a higher length to breadth ratio leading to higher flexibility. Due to the fiber brittleness, smooth and uncrimped surface it causes many difficulties in spinning. Numerous experiments have been reported by the various researchers. It was found that surface modification of fiber by alkali, oil and cold plasma treatment has lead to better spinnability [8], [9], [10]. Panahi et al. reported that milkweed fibers have a hydrophobic and oleophobic surface due to the natural waxes found on the fiber surface [11].

Application of milkweed in different areas of textiles

Yarn production

The surface of the Milkweed fiber is smooth, it consists of uncrimped surface and brittleness [12]. It faces many difficulties in roller lapping, frequent sliver breakage and web condensation at the time of spinning process [13]. Several researchers have worked on improving the surface of the milkweed fibers so that it can lead to the yarn preparation

Sakthivel et al. has done the alkali treatment on the fibers by microscopic its convolutions were observed along the fiber length [14]. Gharehaghaji and Hayat-Davoodi experimented the cold plasma treatment on milkweed fibers which leads to improvement of fiber surface [15]. Dre'an et al. developed the plain fabrics using blended Cotton: Milkweed yarns on Ring spinning systems [16] Karthik and Murugan developed Core: Sheath Cotton: Milkweed yarns [17]. Bakhtiari et al. researchers have developed some knitted fabric samples with interlock structure by the cotton/Milkweed blended ring-spun yarns [18].

Applications of Milkweed fiber in Technical Textiles

Due to the hollow structure Milkweed fiber has a good comfort property, good for skin, wipe drying and wicking which is suitable for applications in nonwoven materials. Rengasamy et al. reported that the raw milkweed fiber has a capacity to absorb oil [19]. Due to the hollow surface, it can be used for sound absorbent fabric [20]. After dewaxing Milkweed fiber can be used as a core layer in the hygiene materials: sanitary pads and diapers etc. The low density of the Milkweed fibers leads to the development of Light weight composite [21].

Conclusions

NITRA (North Indian Textile Research association) has signed MOU with NBRI in the presence of Giriraj Singh, union minister of textiles, to undertake research on 360-degree genomic analysis of the Milkweed plant for the brief analysis for its structural components to accelerate the commercial farming of Milkweed plant [22]. This initiative could lead to the development of an alternative raw material base for the Indian textile industry. NITRA has also developed specific machinery for extracting fibers from seed pod. Nitra has also developed a specific trade mark for Milkweed fiber to fabric production. Hence Milkweed fiber is a upcoming fiber in the field of sustainable textiles.

Keywords: Milkweed, Fiber, Yarn, Textiles, Sustainability

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Changes in Adolescents and Their Behavior Due to Climate Change

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ABSTRACT

Climate change is emerging as the most serious global challenge of the 21st century. It is not only affecting the natural ecosystem but also influencing the social, mental, and emotional structures of adolescents. Adolescence is a sensitive and transitional stage, during which the effects of climate change significantly impact adolescents' mental health, behavior, lifestyle, and attitudes. Various behavioral changes in adolescents can be observed due to climate change, affecting their health, education, social interactions, and cognitive development. In addition, they are facing livelihood crises. Continuous reports of climate change and climate-related crises—such as floods, droughts, forest fires, etc.—are increasing feelings of anxiety, fear, and insecurity among adolescents. They are becoming victims of

stress, depression, and irritability, and tendencies like intolerance and aggression are also being noticed. Due to migration or school closures caused by climate change, adolescents are becoming socially isolated. A lack of economic resources often leads to increased family conflicts, negatively impacting adolescents. Excessive heat in the environment disrupts academic activities, thereby affecting their studies. When livelihoods are threatened by climate disasters, adolescents may be drawn toward labor or even criminal activities. Droughts or crop failures reduce food availability, affecting their physical development. For example, in the Bundelkhand region of Uttar Pradesh, repeated droughts led to agricultural failures, forcing families to migrate. This resulted in a rise in juvenile crimes such as theft, child labor, and fights. According to NCRB reports from 2020 to 2022, several districts recorded an unexpected increase in juvenile offenses following natural disasters.

Possible Solutions: Adolescents should be provided with environmental education so that they become aware and actively contribute toward solutions by participating in programs such as tree plantation, water conservation, etc. Governments should formulate policies that ensure the safety of adolescents' education and health during disasters. Institutions like "Youth Clubs" and "Friend Police" should be established so that adolescents do not lose direction during crises and instead follow the correct path guided by society. According to Strabo, "*The geographical conditions of a nation can make it great.*"

Conclusion: Climate change is having a profound impact on the mental, social, and behavioral aspects of adolescents. If timely strategies and interventions are not implemented, the balanced development of the coming generation may be disrupted. Therefore, it is essential that we listen to, understand, and support adolescents in identifying solutions to the climate crisis.

Keywords: Climate, Change, Adolescents, Behavior, Criminality

Effect of *Aloe barbadensis* on growth, hematology and proximate composition of *Cirrhinus mrigala* (Hamilton, 1822)

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ABSTRACT

The aim of this research was to study the effect of *Aloe barbadensis* gel on growth performance, hematological parameters and proximate composition of *Cirrhinus mrigala*. In this investigation, mrigal fingerlings were divided into four different groups fed on diets containing *Aloe vera* gel in different concentration: 2% (T1), 4% (T2), 6% (T3) and a control group (T0) fed without *Aloe vera* gel for 150 days. The physio-chemical parameters of water in all the treatments remained within optimum range recommended for mrigal fingerlings. The maximum 89.18 survivability was observed in T3 but significantly ($P > 0.05$) not differed among the group. The maximum weight gain (14.93g) and length gain (11.23 cm) was observed in T3. The growth parameters viz. SGR, FCR, FCE, percentage increment in weight and length, and daily weight gain significantly ($P < 0.05$) improved in T3 followed by T2, T1 and control group, respectively. The hematological parameters viz. RBC, WBC, PCV and Hb content significantly ($P < 0.05$) increased in T3. Overall, results indicated that *Aloe vera* gel enhanced the growth, feeding efficiency and hematological parameters and proximate composition in *Cirrhinus mrigala*.

Keywords: Aloe vera gel, Growth, Hematological parameters, Proximate composition, *Cirrhinus mrigala*

**Community Structure and Distribution Patterns of Phytoplankton in Aquaculture Ponds at Hisar
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ABSTRACT

The present study was conducted to investigate the diversity and distribution of phytoplankton communities in a fish pond located at Khariya village, Hisar, from October 2024 to February 2025. Phytoplankton, as primary producers, play a crucial role in maintaining aquatic ecosystem balance and supporting trophic dynamics in fish ponds. Fortnightly water sampling was undertaken, and key physico-chemical parameters such as pH, temperature, electrical conductivity, dissolved oxygen, turbidity, total alkalinity, and total dissolved solids were analysed. The recorded ranges indicated moderately productive water conditions (e.g., pH 7.45 ± 0.20 ; DO 5.88 ± 1.32 mg/L; turbidity 43.28 ± 1.71 NTU).

Phytoplankton community structure was assessed using diversity indices. Shannon's diversity index (H') was 3.53 ± 0.04 , Simpson's index ($1-D$) was 0.03 ± 0.00 , Margalef richness index was 5.68 ± 0.45 , and species evenness was 0.98 ± 0.01 . The results indicated high species richness and even distribution of phytoplankton. Among the observed groups, Chlorophyceae dominated (32%) with 12 genera, followed by Cyanophyceae (22%), Trebouxiophyceae (16%), Zygnematophyceae (14%), Bacillariophyceae (8%), Diatoma (5%), and Dinophyceae (3%). The diversity patterns showed strong dependence on the physico-chemical attributes of the pond. The findings underscore the ecological importance of phytoplankton diversity in sustaining pond productivity and overall water quality in aquaculture systems.

Keywords: Phytoplankton diversity, fish pond ecology, Chlorophyceae, diversity indices

Diversity and Distribution of Soil Nematodes in Selected Vegetable Cropping Systems

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ABSTRACT

Soil nematodes are microscopic, worm-like organisms found in nearly all habitats and play a vital role in the decomposition of organic matter and the cycling of nutrients within soil ecosystems. The present study was conducted at three selected sites within the Vegetable Farm of CCS HAU, Hisar, to investigate the impact of crop rotation on nematode diversity, assess the correlation between soil physico-chemical parameters and nematode populations, and document the biosystematics of dominant nematode taxa. A total of 40 genera belonging to 8 orders and 21 families were identified, including members of the orders Rhabditida, Araeolaimida, Monhysterida, Aphelenchida, Dorylaimida, Tylenchida, Triplonchida, and Enoplida.

Nematode abundance peaked in November 24, followed by October 24, with the lowest counts recorded in December 24 across all three sampling fields. The order *Rhabditida* emerged as the most dominant in terms of both genera and individual abundance at all sampling sites throughout both cropping seasons. All five trophic groups of nematodes were detected during the study period, with bacterivores representing the most dominant group in both generic diversity and individual abundance across all fields and seasons.

Shannon's Diversity Index (H') ranged from 2.1 to 2.7 at Field 1, 1.90 to 2.65 at Field 2, and 2.2 to 2.65 at Field 3, indicating the highest nematode diversity at Field 1, followed by Field 3, and the lowest at Field 2. Statistical analysis revealed a positive correlation between nematode abundance and temperature, while negative correlations were observed with total dissolved solids (TDS), alkalinity, total hardness, and available nitrogen, phosphorus, and potassium (NPK) levels.

Keywords: Crop Rotation, Nematode Abundance, Diversity, Soil Physico-Chemical Parameters

**Molecular Interference by Airborne Pollutants: Toxicity from Ambient Air Contaminants
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ABSTRACT

Air pollution is the biggest health hazards that is faced by whole world nowadays Contamination of air pollution can adversely effect human health. They cannot effect the human body only at the surface level by damaging the cells and tissue associated with the respiratory tract but the ultrafine particles PM_{2.5} can penetrate the biological barriers and the contaminants that are associated with them can interfere with the biological processes by interaction with the biochemical essentials proteins (enzymes) which work as a key factor in various biochemical processes. This literature based study aims to consolidate findings on how airborne pollutants, particularly pm2.5 and volatile organic compounds disrupts molecular pathways leading to toxic effects.

Keywords: Enzyme Inhibition, Oxidative Stress, Vocs Toxicity and Heavy Metal Air Pollutant

Purpose

Air pollution a persistent threat to human health, particularly through exposure to fine particulate matter PM_{2.5} suspended in ambient air and the toxic contaminants such as haevy metals, volatile organic compounds, polycyclic aromatic hydrocarbons associated with these particles. These pollutants not only cause respiratory and cardiovascular damage but also interfere at biochemical enzymes functions which are the key factors in various biochemical processes in human body. This study aims to identify and characterize the ambient air contaminants that competitively or irreversibly inhibit key human enzymes, leading to disrupted biological processes such as neurotransmission, detoxification, and olfactory perception.

Materials And Methods

A comprehensive review of scientific literature was conducted using database PubMed, science direct, and google scholar studies published between 2012 and 2025 were selected based on relevance to molecular toxicology, air pollution and interference with the biological processes . both in vitro and in vivo studies were included. findings were grouped by pollutants type and mechanism of action.

Results

Heavy metals can bind to the active sites of enzyme such as catalase and superoxide dismutase, resulting in loss of enzymatic activity. Molecular docking studies confirm competitive binding with the olfactory enzymes and metalloproteins.

VOCs like benzene, toluene, and formaldehyde include ROS (reactive oxygen species) generation and DNA damage in exposed cells, especially in lung epithelial tissues.

PM_{2.5} carries adsorbed toxicants which penetrate deep into alveolar tissues and trigger systematic inflammation and epigenetic changes like methylation of DNA.

Conclusion

The findings support the urgent need for serious and strict air quality control standards and the inclusion of molecular biomarkers in air pollution risk assessments.

Post-harvest Technologies and Mechanization for Profitability

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ABSTRACT

Post-harvest technologies and mechanization are critical components in enhancing the profitability and sustainability of agricultural production systems. Efficient post-harvest handling, including grading, sorting, packaging, and storage, minimizes losses, preserves quality, and extends the shelf life of produce. The adoption of mechanized solutions such as automated harvesters, conveyors, and advanced packaging equipment reduces labor costs, increases operational efficiency, and ensures uniform product standards. Furthermore, the integration of cold chain logistics, controlled atmosphere storage, and digital monitoring systems improves market access and competitiveness. These advancements not only add value to agricultural commodities but also empower farmers and agribusinesses to meet the growing demands of domestic and international markets. This paper emphasizes that investing in post-harvest technologies and mechanization is essential for achieving higher profitability, reducing food waste, and promoting a resilient agricultural sector.

Keyword: Mechanization, Profitability, Food Loss Reduction, Cold Chain, Value Addition, Storage Technologies, Agricultural Efficiency, Sustainable Agriculture

Residue Dissipation and Dietary Risk Assessment of New-Generation Insecticides in Tomato Fruit

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Purpose

Pesticide residues on vegetables pose a critical challenge to food safety and consumer health. To ensure safe consumption and regulatory compliance, it is essential to monitor the persistence of commonly used insecticides in food crops. The present study aimed to investigate the dissipation behavior and half-life of four novel insecticides applied to tomato fruits at different dose levels and to assess potential dietary risks associated with their residues.

Materials and Methods

Field trials were carried out during the *spring–summer* season on tomato (variety: Pusa Ruby) using a randomized block design with thirteen treatments and three replications. Chlorantraniliprole, emamectin benzoate, spinosad, and indoxacarb were applied at three doses: recommended (RD), 25% higher (1.25RD), and double (DD). Fruit samples were collected at intervals up to 15 days after the second spray. Residue extraction followed a modified QuEChERS method, and quantification was performed using LC–MS/MS. Method validation adhered to SANTE guidelines for recovery, linearity, LOQ. Half-life (DT₅₀), 90% dissipation (DT₉₀), and theoretical maximum daily intake (TMDI) were calculated for consumer safety evaluation.

Results

Residue dissipation for all insecticides followed first-order kinetics. Initial deposits increased with dosage, while residues declined rapidly over time. Half-life values ranged between 1.20–2.20 days for chlorantraniliprole, 1.70–2.20 days for emamectin benzoate, 2.04–2.13 days for spinosad, and 1.60–2.20 days for indoxacarb. All residues fell below their respective MRLs within the recommended pre-harvest intervals. Dietary exposure for rural and urban populations remained well below the maximum

permissible intake across all doses except 2×, indicating negligible health risk when applied as per good agricultural practices.

Conclusions: The tested insecticides demonstrated rapid dissipation under field conditions, ensuring food safety when recommended dosages are followed. The integration of dissipation data and risk assessment provides critical information for policymakers and farmers to maintain consumer health and meet regulatory standards.

Keywords: Dietary risk assessment, dissipation kinetics, food safety, LC–MS/MS, pesticide residues, tomato

Assessment of Constraints and Promotion of Best Agronomic Practices for Enhancing Pigeonpea Productivity in North Karnataka

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Introduction

Pigeonpea (*Cajanus cajan*) is a vital pulse crop cultivated across North Karnataka, contributing significantly to food security and rural livelihoods. Despite its economic importance, pigeonpea yields remain suboptimal due to various production constraints. This study aims to identify the key factors responsible for low productivity and to recommend appropriate agronomic and policy interventions to enhance pigeonpea cultivation.

Materials and Methods

The study was conducted in five major pigeonpea-growing districts of North Karnataka—Kalaburagi, Vijayapura, Bidar, Raichur, and Bagalkot. Four villages were selected per district based on the extent of pigeonpea cultivation. From each village, six farmers were chosen, resulting in a sample size of 120 farmers. Additionally, 75 agricultural scientists, 75 dall mill owners/traders, and 75 officials from the Department of Agriculture were interviewed using a pre-tested structured schedule. Data were collected through personal interviews and analyzed qualitatively and quantitatively.

Results and Discussion

The findings revealed that major constraints to pigeonpea productivity include biotic stresses such as pod borer, wilt, and sterility mosaic disease, and abiotic factors like drought, waterlogging, and nutrient deficiencies. Improper agronomic practices—such as late sowing, inadequate seed treatment, unscientific weed management, and low adoption of improved varieties—further aggravated yield losses. Dry spells in Kalaburagi, Vijayapura, and Bidar during critical growth phases were particularly damaging.

Best agronomic practices identified for overcoming these challenges include deep summer ploughing, application of FYM, seed priming with CaCl₂, adoption of improved varieties (e.g., GRG-811, HY3C, BRG series), ridge and furrow sowing for better water management, and timely foliar sprays like Pulse Magic. Use of machinery for sowing and intercultural operations, intercropping systems, and residue recycling were also found beneficial. Moreover, the study highlighted the need for increased awareness and training through FLDs, OFTs, and FFS, along with establishing better market linkages and promoting secondary agriculture for value addition.

Conclusion

Enhancing pigeonpea productivity in Karnataka requires an integrated approach involving the adoption of improved agronomic practices, robust extension support, and efficient market infrastructure. Addressing the identified constraints through scientific interventions and capacity building can lead to

higher yields, better resource use, and increased income for farmers. Promotion of pigeonpea transplanting, intercropping systems, and development of market linkages are essential for expanding cultivation and ensuring sustainability.

Keywords: Pigeonpea, Agronomic practices, Productivity, Biotic and abiotic stresses, Intercropping, North Karnataka, Extension strategies, Market linkage

Role of Mobile Technology in Enhancing Agricultural Productivity and Empowerment

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ABSTRACT

The agricultural sector in India plays a pivotal role in sustaining the economy, employing over 50% of the population. Despite this, rural farmers face challenges such as limited market access, inadequate information, and vulnerability to climate change. This study investigates the adoption of mobile phones by sixty farmers in Kittur taluka of Belagavi district, Karnataka, focusing on their impact on socio-economic, technical, and political empowerment. Findings reveal that 60% of farmers use smartphones primarily for maintaining interpersonal relationships and accessing agricultural updates. Mobile phones significantly enhance information access, with 90% acknowledging their role in quick information retrieval, while reduced travel costs for 88.33% of users. However, only 45% perceive an increase in income due to mobile usage. Advanced ICT tools like e-journals and applications such as m-Krishi remain underutilized due to low digital literacy. The study identifies key constraints such as high device costs, poor network connectivity, and limited training on mobile technology usage. To address these, recommendations include providing affordable mobile phones, enhancing rural communication infrastructure, and offering digital literacy programs. Mobile technology has proven instrumental in accessing government schemes and improving market linkages, yet its full potential remains underexplored. This research underscores the need for targeted interventions to bridge the digital divide and harness mobile phones for agricultural development.

Keywords: Mobile phones, Rural farmers, agricultural information, socio-economic empowerment, digital literacy, ICT tools

Nutritional Security through Traditional Laddu of North Karnataka

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ABSTRACT

Food is not merely a source of sustenance but also a medium that carries cultural, traditional, and medicinal significance. In rural India, especially among women, children, and marginalized populations. Nutritional security continues to be a pressing challenge. In this context, traditional laddus of North Karnataka—such as *Antina laddu* (edible gum laddu), *Ellu laddu* (sesame and jaggery laddu), groundnut laddu, *Navani laddu* (foxtail millet laddu), dry fruits laddu, besan (gram flour) laddu, and *Ragi Undi* (finger millet laddu)—serve as time-tested household remedies for improving and maintaining nutritional health. These laddus are prepared using regionally available, nutrient-dense ingredients such as jaggery, sesame seeds, edible gum, various millets, pulses, dry fruits, and ghee. Each ingredient contributes uniquely to health: ragi is rich in calcium and iron; edible gum enhances

postpartum recovery; sesame and jaggery supply iron, energy, and essential fats. These foods are particularly beneficial for lactating mothers, pregnant women, growing children, and the elderly. This paper highlights the nutritional potential of these traditional preparations in promoting food-based solutions for malnutrition and micronutrient deficiencies. It also explores the critical role of rural women in preserving, preparing, and pass on these recipes across generations. Moreover, the paper examines how traditional laddu-making can be leveraged for women-led microenterprises and self-help group-based rural entrepreneurship. Some SHGs in Karnataka have successfully taken laddu making as an enterprise. The traditional laddus of North Karnataka offer a culturally accepted, nutritionally rich, and economically viable solution to improve community nutrition and support rural livelihoods, making them highly relevant in today's public health and development frameworks.

Keywords: Nutritional Security, Traditional laddus.

Assessment of Environmental Knowledge and Responsibility among College Students

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Purpose

This study aimed to assess environmental knowledge and responsibility among undergraduate (UG) and postgraduate (PG) students. With environmental challenges intensifying, it is vital to understand youth attitudes toward sustainability. The objectives included evaluating environmental awareness, comparing responsibility levels among UG and PG students, identifying pollution sources, and gauging eco-friendly behavior.

Material and Methods

A structured questionnaire was used to survey 83 students (54 UG and 29 PG) from colleges in Karnataka and Andhra Pradesh. The questionnaire covered socio-economic details, environmental knowledge, responsibility, reuse/recycling habits, and perceptions of pollution factors. Data were analyzed using frequency distribution, Student's t-test, Likert scale interpretation, and Garrett ranking techniques.

Results

The majority of participants (80.72%) demonstrated high environmental knowledge. There was no statistically significant difference between UG and PG students regarding knowledge ($t=1.64$) or responsibility ($t=0.12$). While many students were aware of environmental issues, actual responsible behaviors—such as saving water, using public transport, or choosing organic products—were less consistent. For example, 78.3% rarely saved water, and 72.3% seldom turned off lights when not needed. Garrett ranking indicated industrialization and population explosion as leading causes of pollution, followed by urbanization, lack of awareness, and government apathy.

Conclusions

The findings reveal a high level of environmental awareness among students, but this is not matched by daily responsible actions. Educational level (UG or PG) had no significant impact on knowledge or behavior, suggesting that awareness may be shaped more by upbringing and media exposure. Institutions should promote practical engagement—like green campus initiatives and community-driven campaigns—to bridge the gap between knowledge and action. Empowering students to participate in climate advocacy can strengthen community resilience against climate change.

Keywords: Environmental Knowledge, Responsibility, College Students, Sustainability, Behavior, Pollution, Awareness

Climate Change and Agriculture: Farmer Perceptions and Adaptation Strategies in Andhra Pradesh**Rajeshwari Desai¹, Regatipallya Divya², and Vinuta Muktamath¹**^{1,2,3}*AICRP-WIA, University of Agricultural Sciences, Dharwad***Purpose**

Climate change represents a significant global environmental challenge, primarily driven by the accumulation of greenhouse gases. Agriculture-dependent communities are particularly vulnerable due to declining productivity, unpredictable weather, and resource stress. In India, even a 1°C increase in temperature may reduce crop yields by 3–7%. This study aimed to assess the perceptions of farmers in Andhra Pradesh regarding the effects of climate change on crop production, the problems they face, and the adaptation strategies they follow.

Materials and Methods

The study employed a descriptive research design and purposive sampling technique to select 50 farmers. A structured, pre-tested questionnaire was shared with students from farming backgrounds, who collected data by interviewing their parents. The questionnaire covered demographic profile, agricultural input use, perceptions of climate change, problems encountered, and adaptation practices. Data were analyzed using MS Excel to calculate frequencies and percentages.

Results

Most farmers (88%) were between 25 to 45 years of age, and a majority (57.1%) had families with fewer than four members. Landholding patterns showed that 88.4% owned less than five acres. Education levels varied, with 38.3% having completed secondary school, and 28.3% holding a bachelor's degree.

Groundwater was the primary irrigation source for 65% of respondents, and a noticeable shift to water-efficient methods like sprinklers (32 respondents) and drip irrigation (26 respondents) occurred over the past 10 years. Use of certified seeds was high (48.3% always used), and 53.3% always used chemical fertilizers. Among pesticides, insecticides were most widely used (88.3%). Farmers identified drought (reported by 86%), pest attacks (76%), and heat stress (64%) as major issues. Adaptive responses included intercropping (68%), crop diversification (56%), shifting sowing dates (60%), and mechanization (52%). However, resource-intensive methods like rainwater harvesting and biopesticides were adopted by only 28% and 25%, respectively. Key barriers to adaptation were high input costs (reported by 72%), limited access to credit (68%), and lack of market linkages (54%).

Conclusions

The findings highlight that while farmers are increasingly aware of climate change and are willing to adopt adaptive strategies, structural constraints—particularly high input costs and limited support—hinder effective implementation. Strengthening extension services, improving access to affordable technologies, and ensuring institutional support are crucial for enhancing the adaptive capacity of smallholder farmers in Andhra Pradesh.

Keywords: Climate Change, Farmer Perception, Adaptation Strategies, Agriculture, Andhra Pradesh

Assessing Farmer Perceptions and Adaptive Responses to Climate Change in Crop Production**Rajeshwari Desai¹, Divya Regatipally² and Surekha Sankangoudar³**^{1,3}*AICRP-WIA, University of Agricultural Sciences, Dharwad, Karnataka*²*Dept. of Resource Management and Consumer Sciences, University of Agricultural Sciences, Dharwad, Karnataka***Purpose**

Climate change significantly disrupts traditional farming, posing challenges like delayed crop maturity, increased pest infestations, and decreased yields, compelling farmers to adopt adaptive measures for

agricultural output and livelihood maintenance. This study aims to examine the effects of climate change on crop yields, the difficulties farmers face, and to investigate the adoption of adaptive techniques and factors influencing their implementation.

Material and Methods:

A descriptive research design was employed, collecting data from 120 farmers across Andhra Pradesh (Anantapur, Kadapa, Vishakapatnam, and Vizayanagaram districts) using a pre-tested questionnaire and random purposive sampling. The survey assessed socio-economic profiles, climate change perceptions, adaptation practices, and barriers to adoption. Data analysis involved frequency, percentage, and rank correlation.

Results:

Farmers reported significant climatic variability, including irregular rainfall and delayed monsoons, leading to reduced yields, increased pest infestations, and delayed crop maturation. Adaptation measures, combining traditional and modern methods, were widely adopted, with mechanization (70%), crop rotation (65%), and intercropping (60%) being common. However, obstacles such as high input costs (60%), limited market access (66.60%), and insufficient access to high-quality seeds (60%) hindered the widespread adoption of improved practices.

Conclusion:

The findings highlight the necessity of targeted interventions, including improved seed distribution systems, enhanced market access, and subsidies for agricultural inputs. These actions are crucial for empowering smallholder farmers to overcome barriers, implement sustainable farming methods, and effectively mitigate the negative impacts of climate change on the agricultural sector.

Keywords: Climate Change, Crop Production, Adaptation Strategies, Barriers for Adoption, Problems Faced

Madhubani painting empowerment and encouragement of women of Bihar.

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ABSTRACT

Madhubani (the forest of honey) is in the Mithila region of North Bihar, which has got worldwide recognition due to its art and craft, specially Madhubani painting, Sujani, and Khatwa. It is female female-oriented region which is the birthplace of Sita in the Ramayana. More goddesses are traditionally worshiped in this region. Female members are handling the household management. The culture and tradition make them responsible for household and family activities. They are also engaged in art, craft, and cultural activities. Mithila painting is mostly done by the women even from the most interior and backward areas without much formal education and communication. It started as an art work which has grown as a big market these days. It has become a tool for empowerment of associated women. Their skills have got market value, which has built up confidence among its practitioners. These days, lots of artists and designers experiment to modernize it for its conservation. In this way we can encourage women to empower through its earning. This way, the conservation of traditional arts, crafts, and green fashion can be done.

Keyword: Mithila Painting, Women Empowerment, Green Fashion, Art, Craft Empower, Encouragement, Recognition, Modernization, Designers, Conservation

Do Farmers' Perceptions of Climate Change and Variability Align with Observed Climatic Trends? Evidence from the Saurashtra Region, Gujarat**B. Swaminathan^{1*} and Pokiya N. J.² and Sneha M³**^{1,2,3}*Department of Agricultural Economics, College of Agriculture, Junagadh Agricultural University, Junagadh – 362001, Gujarat.***Purpose**

Indian agriculture is heavily dependent on versatile climatic cues. Any small aberration in regular temperature and precipitation can impose heavy losses on farmers, especially the small and marginal ones who constitute more than 80 per cent of the total farming households in the country. Thereby, the regional studies are pertinent to identify the impact of changes in climatic indicators to enhance the climate readiness of the farmers. The present study is two pronged: (i) trend analysis of weather parameters and (ii) perception of farmers on climate change and variability. The crux of the study is to comprehend whether the farmers' perception and the estimated trends of temperature and precipitation in the Saurashtra region, Gujarat, sink well or show mismatch.

Material and Methods

In the present study, the trend of climatic indicators was determined in the districts of Junagadh, Rajkot, Amreli and Jamnagar using Mann-Kendall test and Sen's slope estimates from 44-year study period data, 1979-80 to 2022-23, obtained from the Agrometeorology Cell, Junagadh Agricultural University, Gujarat. In addition, farm level perceptions of 240 farmers from the same districts were also studied in an attempt to see whether the farmers perceptions on climate change and variability align with that of the observed climatic trends. Besides, Garrett's ranking technique was employed to identify the constraints faced by cotton and groundnut farmers in the region while adapting to climate variability. The respondents were selected using a multi-stage sampling technique and the primary survey was carried out in 2022-23.

Results

The findings revealed that perceptions of the farmers on climate variability and its implications do not align fully with that of the statistically significant increasing trends observed for temperature and precipitation. While 100 per cent of farmers perceived escalating cultivation cost as the major implication of climate change, labour shortage and lack of finance were perceived as major constraints deterring their adaptation to climate change.

Conclusions

Farmers in the Saurashtra region, Gujarat, need to be given exposure and training to 'read' climate better to improve their farm planning and budgeting. Enhancing their access to weather information will in turn enhance their adaptation of strategies at farm level to manage the adverse effects of climate change and variability. Climate intelligence needs to be bolstered with the upgradation of Agricultural Information Kiosks at the local level for the rapid dissemination of knowledge and modern technologies relevant to climate smart agriculture.

Keywords: Temperature and precipitation trends, farmers' perception, adaptation constraints, Saurashtra, Gujarat.

Status and Performance of the Crop Insurance Sector in India: Target- and Business-Centric Payoffs**B. Swaminathan and S. R. Lavanya***Department of Agricultural Economics, College of Agriculture, Junagadh Agricultural University, Junagadh – 362001, Gujarat, India***ABSTRACT**

Crop insurance is the front runner in risk mitigation, offering protection against crop loss on account of aberrant weather and other climatic variability issues. The present study analysed the performance of various crop insurance schemes in India from 2000-01 to 2023-24, with an eye on their state-wise coverage and claim settlement pattern. The findings show that the Pradhan Mantri Fasal Bima Yojana (PMFBY) stood out as the most expansive and impactful insurance scheme, covering 29.5 crore farmers and 37 crore ha, insuring ₹16 lakh crore of crops and releasing ₹1.44 lakh crore in claims to 9.09 crore beneficiaries, on a cumulative basis, during 2016-17 to 2023-24. But the scheme did not fare well in terms of target-centric or business-centric indicators though, wherein the Restructured Weather-Based Crop Insurance Scheme (RWBCIS) performed well with the highest composite index of 0.710 and 0.704, respectively. Zone-wise analysis of the cumulative insurance indicators showed that Central India (Chhattisgarh, Madhya Pradesh, and Uttar Pradesh) reported the largest area per farmer (1.80 ha) and North-East with the highest sum insured (₹71,000 per ha). Further, the hierarchical clustering analysis positioned Maharashtra, Rajasthan, and Tamil Nadu in the top-most cluster for their strong insurance reach and financial metrics. In addition, regression analysis revealed claim ratios (1.12) and premium collection from farmers (0.97) as significant determinants of crop insurance coverage more than any other factor. Overall, the study suggests decentralized, state-specific interventions to improve the adoption and performance of the crop insurance schemes in India.

Keywords: Crop Insurance, Performance, State-Wise Insights, Ranking Metrics**Utilization of CTC Tea Wastes as Supplementary Feed for Catla Carp (*Catla catla*): A Sustainable Approach in Aquaculture****Satyajit Sarkar^{1,3}, Saurabh Chakraborti² and Monoranjan Chowdhury^{3*}**¹*Department of Tea Science, University of North Bengal, Raja Rammohunpur, Dist. Darjeeling, Siliguri-734013, West Bengal, INDIA*²*Office of the Principal, Bidhannagar College, EB-2, Sector-I, Salt Lake, Kolkata-700064, West Bengal, INDIA*³*Taxonomy of Angiosperms & Biosystematics Laboratory, Department of Botany, University of North Bengal, Raja Rammohunpur, Dist. Darjeeling, Siliguri-734013, West Bengal, INDIA***Purpose**

Tea waste, a significant byproduct of the Crush, Tear, Curl (CTC) tea manufacturing process, presents notable environmental concerns. In North Bengal alone, approximately 8–15 million kilograms of Factory Tea Waste (CTC-FTW) are generated annually. Moreover, commercial and domestic consumption of CTC tea contributes a substantial amount of Domestic Tea Waste (CTC-DTW). Improper disposal of these wastes results in soil, water and air pollution leaching harmful substances into agricultural land and degrading aquatic ecosystems through waterborne decomposition.

Materials and Methods

This study evaluates the potential use of CTC-FTW and CTC-DTW as alternative fish feed sources. Fingerlings of Catla (*Catla catla*) were divided into three groups across nine treatment conditions: Group 1: G1 – 100% Oil Cake (OC) [Control]; Group 2: G2A – 75% OC + 25% CTC-FTW, G2B – 50% OC + 50% CTC-FTW, G2C – 25% OC + 75% CTC-FTW, G2D – 100% CTC-FTW; Group 3: G3A – 75%

OC + 25% CTC-DTW, G3B – 50% OC + 50% CTC- DTW, G3C – 25% OC + 75% CTC-DTW, G3D – 100% CTC-DTW.

Each diet was supplemented with oil cake (OC) and administered for 180 days. Growth performance was recorded and fish health was assessed through liver function tests (LFTs) and hematological parameters. The elemental composition (Carbon, Hydrogen, Nitrogen, Oxygen) of the feed was determined using CHNS(O) analysis, while trace element profiling was conducted using ICP-AES. Additionally, the antioxidant activity, total carbohydrate, and protein content of the diets were analyzed.

Results

Fish fed diets containing up to 50% CTC-FTW (G2B) and CTC-DTW (G3B) combined with OC showed significantly enhanced growth metrics and improved LFT and hematological profiles compared to the control group. Analysis of feed components revealed the presence of essential trace elements such as Iron, Copper, Zinc, Manganese, Cobalt, Chromium and Silicon contributing to fish development. Antioxidant activities, including DPPH, ABTS+, Nitric Oxide, Hydroxyl radical scavenging, and FRAP assays, indicated that FTW had the highest antioxidant potential, followed by DTW and OC. Nutritional analyses also showed elevated sugar and protein contents in FTW.

Conclusions

Initial findings suggest that both CTC-FTW and CTC-DTW can serve as viable supplementary or alternative feed ingredients for Catla (*Catla catla*). Their inclusion may improve nutritional intake and growth performance in aquaculture. However, further research is required to validate these outcomes and establish the most effective inclusion ratios. These results highlight the potential for sustainable and cost-efficient feeding practices using tea waste in fish farming.

Keywords: Tea Waste, CTC-FTW, CTC-DTW, Catla, Fish Feed, Aquaculture, Growth Performance, Antioxidant Activity, etc.

Assessing the Impact of Indoor Air Pollution on Self-Reported Health Among Older Adults in India: Evidence from LASI Wave 1 Data

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ABSTRACT

An important environmental and public health concern is indoor air pollution (IAP), especially in developing nations like India, where cooking with biomass fuels is still widespread. This study examines the connection between indoor air pollution (IAP) exposure and self-reported health (SRH) in Indian older adults, using data from the Longitudinal Ageing Study in India (LASI) Wave 1 (2017–2018). After removing 637 respondents with missing dependent variable values and 2,691 with missing independent variables, the final analytical sample comprised 27,560 older adults 60 years of age and above, selected through a rigorous multi-stage stratified probability cluster sampling method. Binary logistic regression was used to analyze the impact of cooking fuel type, kitchen setup, and ventilation on SRH while controlling for demographic, socioeconomic, and health-related factors. The results show that those using solid fuels like wood, dung cakes, kerosene, and crop residue are far more likely to report poor SRH than those using cleaner fuels like biogas or LPG. Additionally, the absence of a separate kitchen and lack of proper ventilation, including cooking in enclosed spaces without exhaust systems, exacerbate health risks. Socioeconomic disparities further influence health outcomes, with older adults from lower-income households, marginalized social groups, and those without formal education exhibiting a higher prevalence of poor SRH. Women and individuals aged 70 and above are particularly vulnerable. The study also highlights regional variations in SRH prevalence, with Southern Indian states reporting the highest burden. These results highlight the urgent necessity of focused legislative actions to enhance indoor air quality, promote cleaner cooking technologies, and enhance

ventilation infrastructure, particularly among vulnerable older populations. Addressing indoor air pollution is crucial for reducing disease burden and improving the overall well-being of India's aging population.

Keywords: Climate change, Indoor air pollution, Older adults, Self-reported health, Solid fuel, Cooking practices

SVPVA-Stabilized ZnO–Pt Nanoparticles by Neem Extract: Synthesis, Characterization, and Enhanced Antimicrobial Activity

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ABSTRACT

Zinc oxide (ZnO) nanoparticles are bio-safe antimicrobial agents. Here we report a green synthesis of sulfonated poly (vinyl alcohol) (SVPVA)-stabilized ZnO nanoparticles using *Azadirachta indica* (neem) leaf extract as a reducing/capping agent, followed by in situ deposition of platinum (Pt) nanoclusters. The as-prepared SVPVA–ZnO–Pt nanocomposites were characterized by UV–Vis, FTIR, XRD, SEM/TEM, EDS, and zeta potential. UV–Vis spectroscopy showed a strong excitonic peak at ~368 nm (band gap ~3.35 eV), in line with literature values (e.g., 363 nm peak for neem–ZnO). XRD confirmed hexagonal ZnO wurtzite ($2\theta \approx 31.8^\circ, 34.4^\circ, 36.3^\circ$) and additional Pt (111)/ (200) peaks at ~39.8° and 46.2°. TEM revealed near-spherical ZnO grains ~40 nm in size (range ~25–60 nm), consistent with DLS (mean ~55 nm, PDI~0.11), and a zeta potential of about –24 mV (stable colloid). FTIR spectra showed O–H and C=O bands (from neem phytochemicals/PVA) and a Zn–O band at ~450 cm⁻¹, confirming ZnO formation and SVPVA presence. Energy-dispersive X-ray analysis detected Zn and O (ratio ~2:1), with additional Pt signal in the coated samples. Antibacterial testing (disk diffusion) against *Escherichia coli* (Gram–) and *Staphylococcus aureus* (Gram+) demonstrated markedly enhanced inhibition: for example, SVPVA–ZnO showed zones of ~13 mm (*E. coli*) and 15 mm (*S. aureus*), whereas SVPVA–ZnO–Pt gave ~18 mm and 22 mm, respectively. These improvements align with reports that Pt-doping boosts ZnO bactericidal efficacy. The synergistic action of SVPVA (for dispersion/stability), phytochemical capping (from neem), ZnO (ROS and Zn²⁺ release), and Pt (enhanced charge separation and additional antimicrobial activity) leads to robust, broad-spectrum antibacterial performance. Our eco-friendly composite thus offers a promising antimicrobial nanomaterial for healthcare and packaging applications.

Keywords: Zinc oxide nanoparticles, SVPVA, Platinum nanoclusters, Neem extract, Green synthesis, Antibacterial activity, Nanocomposites, ROS generation, Phytochemical capping, Biomedical applications, Eco-friendly materials, UV–Vis spectroscopy, FTIR, XRD, SEM/TEM, Zeta potential, DLS, Synergistic effect, Broad-spectrum antimicrobial.

Sous-Vide Technique for Preparing Healthy and High-Quality Fish Products

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ABSTRACT

In the modern era, people are more towards a healthy lifestyle and focused on consuming minimally processed foods that retains its aroma and nutritional quality intact, at the same time convenient and affordable. The sous vide processing technique can fulfill the expectation up to the mark. The French term 'Sous vide' means 'under vacuum'. This technique refers to the process where food is packed in a food-grade vacuum packet and cooked in a water bath at precisely controlled temperature for an

extended period of time, followed by rapid cooling. This method performs at relatively low temperatures ranging from 50-90°C for a long time up to 72 hours. This method is considered superior to traditional cooking, and it differs from traditional cooking methods in two fundamental ways: (i) food material is first vacuum-sealed, and (ii) then cooked for an extended period at controlled low temperatures. This method not only extends the shelf life of the food but also preserves its natural sensory quality. It provides a barrier to food liquid evaporation and results in a soft and juicy textured product. It also prevents loss of heat-labile nutrients and keeps the foods aroma intact. This technique was limited to the food for hospitals or industrial use but nowadays it is adopted by the restaurants and most importantly in the home also. Fish is considered a superfood due to its nutritional and biochemical composition. It contains a good amount of protein @15-24% with all essential amino acids. Fish is also popular for its fatty acid compositions and a good number of vitamins and minerals. As long as fish preservation is concerned and getting the fullest nutrition from the fish, sous vide is the most preferable culinary technique as it ensures excellent texture with perfect doneness. This novel technique offers new culinary and technical possibilities to the fish processing and preservation industry.

Keywords: Sous-vide, Novel technique, Fish preservation, Low temperature, Under vacuum

Hydrocarbons are a necessary bane to climate change

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ABSTRACT

Hydrocarbons are organic molecules composed solely of carbon and hydrogen atoms. They occur widely in nature, for example, the pigments found in plants such as carotenes and natural rubber are nearly 100% hydrocarbon, and they are flammable and release energy when burned, making them important fuels, like coal, oil, and natural gas. Benzene, a simple aromatic hydrocarbon, is a precursor for many synthetic drugs. Thus, hydrocarbons underlie modern energy and industry as they store dense chemical energy and are the main engine of human activities. Hydrocarbons have been playing a vital role in economic development and still dominate energy supply, particularly in developing countries like India, where around 89 per cent of its energy is consumed powered by fossil fuels. Even today, coal forms the major chunk of all the fossil fuels as it generates approximately 75 per cent of the country's electricity. Today, oil, natural gas, and coal supply the majority of global energy. Vehicles such as cars, trucks, ships, and planes are powered almost entirely by hydrocarbon fuels like petrol, diesel, and jet fuel. In industries, hydrocarbons are raw materials for plastics, medicines, and fertilizers. For instance, many plastics and synthetic fibers are long-chain hydrocarbons. Even the construction of renewable infrastructure relies on hydrocarbons, as steel and cement manufacturing consume large amounts of coal or natural gas. In a natural context, hydrocarbons are part of the Earth's carbon cycle, as the carbon in fossil fuels was once absorbed from the atmosphere by ancient life.

Nitrogenous fertilizers silent threat to climate change

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ABSTRACT

Nitrous oxide is a potent greenhouse gas that often escapes public attention in favour of carbon dioxide or methane, yet it has a global warming potential nearly 270 times greater than carbon dioxide over 100 years. Beyond trapping heat, nitrous oxide persists in the atmosphere for more than a century and

contributes to ozone layer depletion, amplifying ultraviolet radiation at Earth's surface. In India, nitrous oxide emissions account for over five percent of the nation's total greenhouse gases, with the country ranking among the world's top four emitters. As India balances its ambitions for food security and rural development with international climate commitments, addressing this "silent" driver of warming is increasingly critical. This is also true with farming, as the use of excessive nitrogen fertilizers is increasing to achieve higher yields. A shift in farming systems, like natural farming, zero tillage, and organic agriculture, is paving the way for nitrogen reduction in the environment. Every effort is made by the Government to encourage small farmers to use fertilizers judiciously. To achieve substantial nitrous oxide reductions, India is expanding access to soil testing laboratories, scaling up precision farming technologies, and deepening outreach to smallholder farmers. Mandating advanced fertilizer formulations and enforcing industrial emission standards will close significant gaps. International collaboration under climate and ozone protection frameworks can facilitate technology transfer and finance, accelerating the deployment of low-emission solutions. By uniting policy, innovation, and community engagement, India can slash nitrous oxide emissions by at least 40 percent, securing a more resilient climate future while sustaining agricultural growth and rural livelihoods.

Integrating Precision Agriculture with Soil and Water Conservation: Pathways to Sustainable and Resilient Farming

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ABSTRACT

Precision agriculture (PA) is revolutionizing modern farming by combining advanced technologies with environmentally conscious practices to enhance productivity while conserving critical natural resources such as soil and water. By leveraging tools such as GPS-guided machinery, geographic information systems (GIS), Internet of Things (IoT) sensors, drones, and artificial intelligence (AI), PA enables site-specific crop management that aligns agricultural output with sustainability goals. This approach reduces excessive input use, supports efficient irrigation, and limits negative environmental impacts such as nutrient leaching and soil erosion. In the context of soil and water conservation, precision technologies facilitate optimized irrigation scheduling, nutrient application, and land management strategies. Innovations like variable rate technology (VRT), AI-driven predictive models, and real-time environmental monitoring allow for tailored interventions that improve water use efficiency, preserve soil health, and increase crop resilience, particularly vital in regions facing climate stress, water scarcity, or soil degradation. Practices such as conservation tillage, cover cropping, buffer zones, and prairie strips further enhance soil structure and moisture retention while protecting ecosystems. Recent developments in digital twin simulations, robotic soil sampling, and remote sensing have expanded the capability of farmers to make informed decisions on a micro-scale. Case studies from regions like Karnataka (India), the U.S. Midwest, and Australia demonstrate tangible benefits such as up to 90% reduction in agrochemical use, 50% water savings, and significantly improved yields and soil health. Despite its potential, widespread adoption of PA-conservation integration faces challenges, including high initial investment costs, limited rural connectivity, and the need for farmer education and policy support. However, emerging solutions such as AI-powered cluster farming models and affordable sensor technologies are beginning to bridge these gaps. This study examines the synergy between precision agriculture and soil-water conservation strategies, highlighting key technologies, field-tested innovations, and successful regional implementations. It emphasizes the economic, environmental, and resilience-based benefits of integrating these approaches and underscores the importance of ongoing research, training, and policy frameworks to support global scalability. As agricultural systems face

increasing pressure from climate change and finite resource availability, precision conservation agriculture emerges as a crucial strategy for sustainable, climate-resilient, and productive farming.

Keywords: Artificial Intelligence (AI), Conservation, Irrigation, Precision Agriculture (PA), Sustainability.

An Empirical Study of perception and market linkage of Farmer-Producer Organizations (FPOs) in India

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ABSTRACT

The research entitled “An Empirical Study of Perception and Market Linkage of Farmer Producer Organization (FPOs) in India” was to investigate perception, market-linkage, marketing-cost, and margin among FPO members and non-FPO members, as well as constraints faced by FPO members in Samastipur district of Bihar. The regression analysis was fitted to the data to analyse the dependent variable i.e., perception of FPO member, which shows the model was satisfactory at $p < 0.10$ ($p = 0.057$) whereas regression model indicates limited significance in explaining non-FPO members' perception variability. FPO members (53.33%) exhibited the highest level, while non-FPO members (71.67%) displayed a medium level of backward linkage. In forward linkage, FPO members (91.66%) had a medium level, whereas non-FPO members (100%) medium level of forward linkage. The data analysis employed R Square and ANOVA on FPO members and non-FPO members, which shows that the overall fit of the model was satisfactory at ($p < 0.05\%$). The score of marketing cost for FPO member and non-FPO member is 512.05 and 594.25 respectively, which is high for non-FPO member. The score of margin for FPO member and non-FPO member is 788.767 and 669.167 respectively, which is high for FPO member. The constraints under different categories are lie as, 'uncertainty regarding the field-worthiness of FPOs (93.33%)', was ranked highest by members, 'postponement of profit sharing' held the paramount position (21.67), 'absence of adequate storage facilities' and 'absence of processing facilities,' both assigned the top rank at 100 percent, 'insufficient business expertise (91.67%)' as the primary concern, 'far-off market and expensive transportation (95.00%)' stood out prominently. The research concludes that chances of market linkage will be very high if the social participation, scientific motivation and education of FPO member increases. Non-FPO members should join Farmer Farmer-Producer Organisation to receive maximum margin in selling of produce.

Keywords: Bihar, FPO, FPO Member, Margin, Marketing cost, Marketing linkage, Perception

Ethnicity and Interpersonal Intelligence: Exploring Cognition and Mental Health in Cross-Cultural Contexts**Brij Kishore Singh¹ and U.V Kiran²**¹*Department of Human Development and Family Studies, College of Community Science, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur, Uttar Pradesh*²*Department of Human Development & Family Studies, School for Home Sciences, Babasaheb Bhimrao Ambedkar University, Vidya Vihar, Raebareilly Road***ABSTRACT**

The term *ethnicity*, derived from the Greek word meaning 'a people or tribe,' refers to a social construct that categorises individuals based on shared cultural, social traits. Cognition involves acquiring and processing information. Mental health is a state of well-being for handling stress and functioning effectively. Interpersonal intelligence is the ability to understand and respond to others. The study aimed to examine the impact of ethnicity on cognitive failure, mental health, and interpersonal intelligence among adult college-going students. A correlational research design was employed to examine the impact of ethnicity on cognitive failure, mental health, and interpersonal intelligence. 331 sample data were collected using purposive random sampling technique from respondents of five different zones of India. A demographic information sheet and standardised tools like the Cognitive Failures Questionnaire, Mental Health Continuum, DASS, and Interpersonal Intelligence Scale were used. Finding revealed that 59.8% of respondents maintained a normal BMI, and 45.0% preferred light physical activity, with only 6.3% engaging in vigorous exercise. Female participants and rural students exhibited significantly higher levels of cognitive failure compared to their male and urban counterparts. The Central region recorded the highest mean cognitive failure score ($\mu = 49.21$, $SD = 6.77$). Interpersonal intelligence was notably higher among female respondents ($\mu = 65.44$) and those from urban areas ($\mu = 65.81$), with the Northern region participants scoring the highest ($\mu = 65.72$). On the other hand, male participants reported significantly better mental health outcomes than females, as measured by the Mental Health Continuum. Finally, the findings suggest that higher levels of physical activity are associated with improved mental health outcomes and reduced cognitive failure, highlighting the importance of active lifestyles for psychological and cognitive well-being.

Keywords: Cognitive Failure, Ethnicity, Interpersonal Intelligence, Mental Health, Physical activity.

Studies Of Rice Blast In Madhya Pradesh, India**Shraddha Karcho***College of Agriculture, Waraseoni, Balaghat, (JNKVV, Jabalpur)***ABSTRACT**

Over the past ten years (2015–2024), rice blast, caused by the fungal pathogen *Magnaporthe oryzae*, has remained a persistent threat to paddy cultivation in Madhya Pradesh, particularly in irrigated lowland areas. Disease incidence in the region has generally ranged between 15% and 30%, with certain years and locations such as the Balaghat region experiencing severe outbreaks in susceptible varieties. Favorable climatic conditions, including prolonged leaf wetness, high humidity, and moderate night-time temperatures during the *kharif* season, have consistently supported pathogen development and rapid spread. Additional contributing factors include excessive nitrogen fertilization, poor drainage, and the continued use of high-yielding but blast-susceptible rice varieties. The fungus thrives on infected crop residues and volunteer rice plants, allowing it to survive between seasons and initiate new infections. Moreover, its high genetic variability and adaptive nature challenge long-term disease resistance efforts. The role of rice blast in Madhya Pradesh has been profound, influencing farmers' decisions on crop selection, driving shifts in local cropping patterns, and shaping extension services and

research agendas. In rice-dominant districts, frequent blast outbreaks have led to increased dependency on chemical controls, greater demand for resistant varieties, and growing concern over economic losses. Without timely and integrated disease management such as the adoption of resistant varieties, seed treatment, optimized fertilizer and irrigation practices, crop residue disposal, and targeted fungicide application—Madhya Pradesh could face recurring rice blast epidemics leading to significant yield losses, ranging from 25% to 50%. Such losses not only impact farmer incomes but also pose a threat to the state's food security and agricultural sustainability.

Keywords: Rice Blast, Cropping Pattern and fertilizer

Assessment of Soil Health Improvement under Natural Farming Practices in Eastern India

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ABSTRACT

Natural farming is increasingly recognized as a sustainable alternative to conventional agriculture due to its emphasis on biological processes, minimal external inputs, and enhancement of natural soil fertility. A field-based study was conducted at the Krishi Vigyan Kendra (KVK), Rohtas (Bihar), to evaluate the impact of natural farming practices on soil health over a period of two years (July 2022 to November 2024). Periodic soil samples were collected and analyzed for key physico-chemical properties—pH, electrical conductivity (EC), organic carbon (OC), and available macronutrients (N, P, K).

The study revealed a progressive enhancement in soil quality indicators. Soil pH remained within the slightly acidic to near-neutral range (5.60–6.20), supporting optimal nutrient availability. EC values were consistently low (0.14–0.28 dS m⁻¹), indicating negligible salt accumulation, a key advantage of avoiding synthetic fertilizers. Organic carbon showed a sustained increase from 0.64% to 0.72%, reflecting improved carbon sequestration due to organic amendments such as Beejamrit, Ghanjeevamrit, jeevamrit, mulching, and residue incorporation. Available nitrogen content increased significantly by 13.8%, from 268.16 to 305.24 kg ha⁻¹, likely due to enhanced microbial activity and biological nitrogen fixation. Similarly, phosphorus and potassium levels increased by 13.2% and 10.7%, respectively, attributed to microbial solubilization and recycling of organic residues. These improvements collectively indicate that natural farming fosters a biologically active and nutrient-rich soil environment, supporting long-term sustainability without reliance on chemical inputs.

These findings are consistent with earlier reports by Palekar (2019) and Khadse et al. (2017), who emphasized the role of Zero Budget Natural Farming (ZBNF) in regenerating soil health. The increase in soil organic matter and macro-nutrient availability reinforces the potential of natural farming in addressing soil degradation and input dependency, particularly in resource-constrained regions like eastern India.

Keywords: Natural Farming, Soil Health, Organic Carbon, Sustainable Agriculture, Physico-Chemical & Biological Properties, Agroecology

Restoring Bauxite Residue: Green Solution To Industrial Waste Management

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ABSTRACT

Bauxite residue, commonly known as red mud, is an alkaline industrial waste generated during the extraction of alumina from bauxite ore through the Bayer process. For every tonne of alumina produced, approximately 1.2 to 1.5 tonnes of bauxite residue is generated, posing significant environmental and disposal challenges due to its high pH (10-13), salinity, and the presence of heavy metals such as Fe, Al, Ti, and trace elements like As, Cr, and V. The high alkalinity and poor nutrient content make the residue ecologically hostile and biologically inactive. Bioremediation, particularly phytoremediation, has emerged as a sustainable, eco-friendly approach for the detoxification and stabilization of bauxite residue through the use of specific plant species and microbial interventions. Among the potential phytoremediators, bamboo (genus *Bambusa* and *Dendrocalamus*) has shown promising results due to its fast growth rate, extensive root system, high biomass production, and tolerance to heavy metals. Bamboo species can ameliorate bauxite residue by reducing pH, enhancing organic matter content, immobilizing heavy metals, and improving the physicochemical properties of the substrate. Their root exudates and rhizosphere microbial interactions play a critical role in metal solubilization and transformation, thereby promoting metal uptake, stabilization, or exclusion mechanisms. Furthermore, the introduction of Plant Growth-Promoting Rhizobacteria (PGPR) enhances bamboo's survival and remediation efficiency by improving nutrient uptake and stress resistance. This study underscores the potential of bamboo-based phytoremediation as a low-cost and sustainable strategy for the ecological restoration of bauxite residue-affected sites, offering an integrated solution for industrial waste management and land reclamation.

Keywords: Bauxite residue, waste management, bioremediation, phytoremediation

Effect of soil on regeneration pattern of *Pinus roxburghii* and *Quercus leucotrichophora* forests of Mussoorie forest division

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ABSTRACT

The present study was carried out on two dominant forest types were identified along and elevational gradient in Mussoorie Forest Division. The dominant tree species were *Quercus leucotrichophora* and *Pinus roxburghii*. Followed by *Acer oblongum*, *Rhododendron arboreum*, *Quercus floribunda*, *Cedrus deodara*, *Myrica esculenta*, *Ficus nerifolia*, *Cupressus torulosa* and *Prunus cerasoides*. Tree and sapling species richness, density and diversity were high in *Quercus leucotrichophora* dominated forest and total basal area and concentration of dominance were maximum in *Pinus roxburghii* dominated forest. Seedling species richness was maximum in *Pinus roxburghii* dominated forest and density, diversity and concentration of dominance were maximum in *Quercus leucotrichophora* dominated forest.

These forests have been under a tremendous biotic stress as they provided fuel, fodder and leaf fodder. Concentration of human settlements in the oak forest areas, lopping and felling and occasional fire spreading from pine forest, have reduce the area under oak forest. Banj oak forms the matrix species of forest in this zone, and is used by the villagers mainly for fuel, fodder, leaf litter and timber.

Therefore, one of the immediate ecological problem is this region is revival of the oak forests, which is turn involves vegetational study, evaluation of regeneration status and subsequently the factor influencing the regeneration. The pine forests have witnessed severe anthropogenic disturbances. The disturbances were mainly in the form of deforestation, animal grazing, lopping, surface burning and litter removal. These continued disturbances are affecting the stability of the ecosystem and retarding the succession process. It is important to note that the regeneration mode of tree species in gap may be changeable, however, in warm – temperate forest, it has been suggested that the regeneration mode of tree species in gaps is not an unchangeable property, but becomes a changeable one in relation to the presence or absence of other species such as key dominant species.

Key words: Vegetation, Regeneration, *Q. leucotrichophora*, *P. roxburghii*, Forest

Protected Cultivation of High-Value Vegetables: Innovations and Challenges

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ABSTRACT

Protected cultivation has emerged as a transformative technology in modern horticulture, enabling year-round production of high-value vegetables such as capsicum, cucumber, tomato and leafy greens. By offering a controlled environment, structures like polyhouses, shade nets and insect-proof net houses help overcome climatic adversities, reduce pest and disease incidence and optimize the use of water and nutrients. Recent innovations include low-cost polyhouse models, hydroponics, fertigation systems and automation tools such as sensor-based monitoring and climate control mechanisms. These advancements have significantly improved yield, quality, and input-use efficiency, particularly benefiting peri-urban and resource-poor farmers. However, challenges such as high initial investment, lack of technical know-how, limited access to quality planting material and energy dependency hinder its widespread adoption. Moreover, region-specific customization of structures, pest dynamics under microclimates and sustainable waste management require focused research and policy support. This abstract aims to highlight the latest technological interventions in protected cultivation, discuss constraints faced by growers and explore future prospects for expanding its adoption, thereby ensuring enhanced income, resource-use efficiency and food security.

A study on the adoption and impact of satellite-based soil health reports in agriculture: enhancing farming practices and sustainability

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ABSTRACT

The study focuses on the use of satellite-based services in the agricultural industry. The study aims to assess the benefits and effectiveness of these services for 60 farmers from Karnataka, and also to understand the impact of application usage, and evaluate its profitability towards farming practices. The research methodology involves collecting data through primary and secondary sources, including interviews with farmers using the satellite-based services and analysis. The findings reveal that precision agriculture and satellite-based services have the potential to improve farming practices, increase efficiency, and promote environmental sustainability. However, there are challenges related to infrastructure, awareness, and adoption among farmers. The study highlights the importance of satellite-based services in transforming the agricultural sector and empowering farmers for better decision-making, profitability, and sustainability.

Keywords: Agricultural Sector, Farmers, Satellite-Based Services, Sustainability

Impact Assessment of Climate Resilient Technologies in Semi-Arid Marathwada Using Double Difference Approach

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ABSTRACT

This study explores the impact of Climate-Resilient Agricultural Technologies (CRTs) introduced under the National Innovations in Climate Resilient Agriculture (NICRA) project in the drought-prone Marathwada region of Maharashtra, India. Using a quasi-experimental design and the double-difference (Difference-in-Differences) estimation method, data were collected from 240 farmers—120 NICRA beneficiaries and 120 non-beneficiaries—across six villages in Parbhani, Jalna, and Chhatrapati Sambhajinagar districts. The study assessed CRT impacts on key indicators, including irrigation, cropping intensity, crop diversification, cost of cultivation, yield, and net farm income. The results reveal significant benefits for NICRA beneficiaries. Cropping intensity increased from 132% to 179%, irrigated area rose from 20.9% to 37.3%, and net income grew by over 200% (₹31,975 to ₹95,913), compared to a 103% increase for non-beneficiaries. Crop-wise yield improvements were notable: cotton (40.8%), soybean (43.1%), chickpea (40.9%), maize (23%), and sugarcane (31.2%). Diversification into horticulture, livestock, and high-value crops like turmeric and vegetables was prominent, with the crop diversification index increasing from 0.59 to 0.81. CRTs—including intercropping, micro-irrigation, soil health management, and drought-tolerant varieties—were perceived as effective adaptation strategies. The findings underscore the potential of CRTs to enhance resilience, productivity, and income in climate-vulnerable farming systems. Expanding such interventions through supportive policy frameworks, localized extension services, and investment in climate-smart infrastructure is critical for sustainable agricultural transformation in India.

Keywords: Climate Resilience, NICRA, Agricultural Technologies, Farm Income, Yield Impact, Difference-in-Differences, Marathwada, India

Role of ligno-cellulolytic microbial consortia on *in-situ* decomposition of paddy residue and its effect on Glomalin Related Soil Protein and Soil Respiration in Vertisols

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ABSTRACT

The field experiment was conducted in a vertisols at a farmer's field in Sukhisewania tehsil, Bhopal (MP). The experiment was laid out in a randomized block design (RBD) with three replications comprising 7 treatments. The treatments were designed as follows, T₁, control; T₂, Burning of straw; T₃, Incorporation of paddy straw; T₄, Paddy straw + urea @ 0.5%; T₅, Paddy straw + cow dung slurry (4t/ha); T₆, Paddy straw + urea @ 0.5% + *Aspergillus sp.* + *Bacillus sp.* + *Streptomyces sp.*; T₇, Paddy straw + cow dung slurry (4t/ha) + *Aspergillus sp.* + *Bacillus sp.* + *Streptomyces sp.*

The rice-wheat cropping system generates huge quantities of crop residues. Inoculation with lignocellulolytic microbes might be an effective alternative to *in-situ* burning to make the paddy straw

composting process economically viable in a short period of time. The compost serves as an excellent source of nutrients in organic farming and mitigates the ill effects of the use of chemical fertilizers. Glomalin-related soil protein component is produced by Arbuscular Mycorrhiza and plays an important role in soil aggregation. The glomalin produced from some crop rotation cropping systems could promote aggregate stability. The Easily Extractable Glomalin Related Soil Protein (EEGRSP) in field experiment was highest under treatment receiving in situ incorporation of paddy straw with urea + microbial consortia and lowest in burning of paddy straw i.e. 77.91 and 75.92 $\mu\text{g g}^{-1}\text{soil}$ and also TGRSP protein was higher under treatment (T₆) i.e. 357.14 $\mu\text{g g}^{-1}\text{soil}$ and In-situ burning of paddy straw resulted lowest production (340.82 $\mu\text{g g}^{-1}\text{soil}$). TGRSP and EEGRSP was not affected by organic treatments and different treatments was found not significant. The soil respiration was significantly more under treatment receiving in situ incorporation of paddy straw with urea + *Aspergillus* spp.+*Bacillus* spp.+*Streptomyces* spp. (T₆) i.e. 24.80 $\text{mg CO}_2\text{-C } 100\text{g}^{-1}\text{soil day}^{-1}$ followed by *in-situ* incorporation of paddy straw + cow dung slurry + *Aspergillus* spp.+*Bacillus* spp.+*Streptomyces* spp.(T₇) (23.44 $\text{mg CO}_2\text{-C } 100\text{g}^{-1}\text{soil day}^{-1}$). Straw incorporation with microbial consortia increased CO_2 production as compared to the control and burning treatments. Burning of paddy straw resulted lowest value of $\text{CO}_2\text{-C}$ i.e. 12.33 $\text{CO}_2\text{-C } 100\text{g}^{-1}\text{soil day}^{-1}$.

The experimental results indicated that the consortium is more effective than any individual isolate. The data show enough promise in the sustainable production of organic fertilizer using the consortium. depletion of the carbon content in *in-situ* burning may favor organisms able to produce extracellular enzymes to break down more stable fractions of SOM as It might be due to fact that the SOM decomposition not only depends on the substrate biochemistry but also on the ability of the existing microbial community to decompose the available substrate. AMF and their product glomalin related soil protein (GRSP) play a decisive role in the soil aggregation, affecting the carbon (C) dynamics in agroecosystems. It can provide an option to the farmers for effective utilization of their farm waste with eco-friendly technology.

Keywords: Arbuscular Mycorrhiza, ligno-cellulolytic microbial consortia, glomalin, Protein, soil respiration

Influence of Crofton weed on seed germination pattern of *Geranium nepalense* Sweet **Gyanu Thapa Magar^{1,2}, Krittika Kaewchumnong³, Lal B Thapa^{1*}, Mohan Siwakoti¹**

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ABSTRACT

Ageratina adenophora is one of the highly problematic species pose a significant threat to the structural and functional regulation of native plants and creating monostand of its own. It increased allelopathic interactions that can alter germination and early growth of native species. However, some native plants are growing over generations in proximity to invasive species, in such extent how parental history of native population influences their offspring early growth and germination ability remains poorly understood. Thus, we aimed to address this critical gap in reference to native herb *Geranium nepalense* Sweet. Pot experiment was carried with seeds of *G. nepalense* collected from *A. adenophora* invaded and uninvaded sites in Kirtipur area, Nepal. Seeds were grown with and without leachate and litter of *A. adenophora*. Germination and growth parameters were calculated. The germination percent was found to be high in litter and leachate treatments in both experienced and unexperienced seeds, while germination was low with the seeds in control treatments. Coefficient of velocity of germination (CVG) was higher and mean germination time was lower in litter treatment than control and leachate for experienced seeds, whereas the result was contrasting in case of unexperienced seed. Meanwhile, both

litter and leachate have positive effect on GI and GRI for both types of seeds. The unexperienced seeds without litter and leachate performed lowest values of GI and GRI. It indicates better germination by the seeds from parental history with invasion stress. Interestingly, Germination uniformity (GU) was low for experienced seeds, indicating uniformity in germination. Root length and biomass of seedlings were significantly higher for experienced seeds comparing to unexperienced one. In conclusion, better germination and resource allocation to root development supports *G. nepalense* for survival under invasion. These findings add information on seedling response to invasion stress based on their parental experience to invasion.

Keywords: Ageratina Adenophora, Competition Success, Germination Performance, Parental History

Chemical insecticides alternative for Management of major pests of groundnut

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ABSTRACT

An experiment to evaluate newer insecticides against major pests in groundnut was carried out in randomized block design with thirteen treatments and three replication on experimental farm at oilseeds research station, Latur. The observations on pest incidence and predators were recorded one day before imposing treatment and three and seven days after imposing the treatments from five randomly selected plants of each plot. Data so collected was subjected to statistical analysis and results were interpreted. Among the treatment for the control of the treatment of emamectin benzoate was found significantly superior for control of defoliator and leaf miner in groundnut and was at par with treatment of spinosad followed by Chlorantraniliprole. The highest pod yield gross and net monetary returns was recorded by the treatment of emamectin benzoate (i.e. 3121kg/ha) followed by the treatment of Spinosad, Chlorantraniliprole (2981 and 2891kg/ha) and were on par with each other. For management of defoliators and leaf miner in groundnut spraying of Emamectin benzoate (5 WSG 100g/ha) or Chlorantraniliprole 20 SC (100 ml/ha) or Profenofos 50 EC (1000 ml/ha), immediately after initiation of pest infestation is found effective, economical and safe to natural enemies compare to other chemicals under experimentation

Keywords: Groundnut, Defoliators Leaf Miner and Natural Enemy

Phytoxicity and Bio-safety of Chemical insecticides used for management Chilli pest

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ABSTRACT

A field experiment was carried out at Vegetable Research Station, Farm, Marathwada Agricultural University, Parbhani, in RBD with eight treatment and three replications. Observations on phytotoxicity symptoms such as leaf injury, leaf yellowing, wilting, vein clearing, necrosis, epinasty and hyponasty during the study period on each observation plant in the field were recorded on one day before and 2, 7, 14 and 21 days after each spray. Total count of larvae and adults of predatory ladybird beetle *Coccinella spp.* were made from top, middle and bottom three leaves from total plants in the plot on one day before spray and 2, 7, 14 and 21 days after each spray. The insecticidal treatment acetamiprid 80g a.i. /ha had highest phytotoxic effect on chilli plants, this was followed by acetamiprid 40g a.i. /ha, imidacloprid 20 g a.i. /ha, Pride (acetamiprid 20g a.i. /ha), acetamiprid 20g a.i. /ha and acetamiprid 10g a.i. /ha which were very slight and can be tolerable. However the treatment of monocrotophos 200 g a.i.

/ha and untreated control did not record any phytotoxic effect. In case of biosafety towards natural enemy of the pest the highest population of ladybird beetle was observed in untreated control and all the insecticidal treatments were harmful, to ladybird beetle. However, the most harmful treatments were acetamiprid 80g a.i. /ha and monocrotophos 200 g a.i. /ha in which not a single ladybird beetle was observed. These treatments were followed by Pride (acetamiprid 20g a.i. /ha), imidacloprid 20 g a.i. /ha, acetamiprid 40g a.i. /ha, acetamiprid 20g a.i. /ha and acetamiprid 10g a.i. /ha. However all the insecticidal treatments were intermediate and at par with each other.

Keywords: Chilli, Phytotoxicity, Bio-Safety, Predators and Chemical Insecticides.

Effect of finger millet (*Eleusine coracana* L.) varieties to different spacing in *kharif*

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ABSTRACT

A field experiment was conducted during the *kharif* 2024 season at the Experimental Farm, Agronomy Section, College of Agriculture, Latur to study the effect of finger millet (*Eleusine coracana* L.) varieties to different spacing in *kharif*. The experiment was laid out in a Split Plot Design with two factors and replicated thrice. The main plot treatments consisted of three varieties: V₁ (Phule Nachani), V₂ (Phule Kasari), and V₃ (Dapoli-1), while the subplot treatments included three row spacings: S₁ (30 cm × 10 cm), S₂ (45 cm × 15 cm), and S₃ (45 cm × 20 cm). The results revealed that the variety **Dapoli-1 (V₃)** recorded the highest values for growth parameters such as number of tillers plant⁻¹ (3.12), number of leaves plant⁻¹ (45.5), dry matter production plant⁻¹ (41.2 g), mean leaf area (5.1 dm²), and leaf area index (0.99), significantly outperforming V₂ (Phule Kasari) and V₁ (Phule Nachani). The highest grain yield (1794 kg ha⁻¹) and biological yield (7858 kg ha⁻¹) and harvest index (24.13%) were also recorded under Dapoli-1 (V₃), which was significantly superior to the other varieties. However, **Phule Nachani (V₁)** recorded the tallest plants (104.4 cm), which was statistically at par with V₂ and significantly taller than V₃. Among row spacings, **S₃ (45 cm × 20 cm)** recorded the highest number of tillers plant⁻¹ (3.24), number of functional leaves plant⁻¹ (45.6), and leaf area plant⁻¹ (4.88 dm²), which was at par with S₂ (45 cm × 15 cm) and significantly superior to S₁ (30 cm × 10 cm). The tallest plants (105.4 cm) and maximum leaf area index (1.42) were recorded under S₁ (30 cm × 10 cm). However, the highest dry matter accumulation plant⁻¹ (46.8 g), grain yield (1887 kg ha⁻¹), and biological yield (8136 kg ha⁻¹) were recorded under **S₂ (45 cm × 15 cm)**, which was statistically at par with 45 cm × 20 cm (S₃) and significantly superior to 30 cm × 10 cm (S₁).

Keywords: Finger millet, row spacings, grain yield, varieties.

Effect of nutrient management practices on growth and yield of fodder sorghum (*Sorghum bicolor* L.Moench)

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ABSTRACT

The field investigation entitled "Effect of different nutrient management practices on growth and yield of fodder sorghum (*Sorghum bicolor* L.)" was conducted during *kharif*-2024 at Experimental Farm, Agronomy Section, College of Agriculture, Latur. The experimental field was levelled and well-drained. The soil of the experimental plot was low in available nitrogen (137.98 kg ha⁻¹), low in available phosphorus (9.65 kg ha⁻¹), high in available potassium (1045.60 kg ha⁻¹), and slightly alkaline in reaction (pH 7.35). The soil was clayey in texture, which was favourable for the normal growth of the crop. The experiment was laid out in a Randomized Block Design with eight treatments and replicated

thrice. Whereas, treatments are T1- control, T2- 100% RDF, T3- 100% RDF with Micronutrient Gr-II @ 0.5 % spray, T4-100% RDF with Urea spray @ 2 %, T5- 100 % RDF with 2 % DAP spray, T6- 75 % RDF with micronutrient grade II 0.5 % spray, T7- 75 % RDF with 2 % urea spray and T₈ – 75 % RDF with 2 % DAP spray. Full dose of P & K and half dose of N as basal & remaining half dose of N as top dressing at 30 DAS. Foliar application of Urea and DAP @ 2% and Micronutrient Grade-II @ 0.5 % at 30 DAS as per treatment. The experimental gross plot size was 5.4 x 4.5 m², and the net plot size was 4.5 x 3.9 m². Sowing was done by dibbling method on 29th June, 2024, and harvested on 22nd Sept., 2024. The results showed that application of 100% RDF with Urea spray @ 2 %, (T3) recorded significantly higher growth attributes *i.e.*, plant height (243.27 cm) plant⁻¹, number of functional leaves plant⁻¹ (14.10), leaf area plant⁻¹ (71.00 dm²), stem girth plant⁻¹ (8.37 cm), fresh weight per plant (1187.43 g) and yield attributes *i.e.*, maximum green fodder yield (462 q ha⁻¹), leaf: stem ratio (0.39) with higher GMR (₹ 1,15,526 ha⁻¹), NMR (₹ 64978 ha⁻¹) and B: C ratio (2.7) which was at par with 100 % RDF with Micronutrient Gr-II @ 0.5 % spray (T3).

Keywords: Fodder sorghum, nutrient management, Growth, Yield, Green Fodder yield

Response of Sunflower (*Helianthus annuus* L.) to nano-DAP in the *kharif* season

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ABSTRACT

A field experiment was conducted at Experimental Farm, Agronomy section, College of Agriculture, Latur, during *kharif*, 2024, to study the response of Sunflower (*Helianthus annuus* L.) to nano-DAP in the *kharif* season. The soil of the experimental site was clayey in texture. The experiment was laid out in a Randomized Block Design (RBD) with eight treatments replicated thrice. The treatments were T₁ - Control (No Fertilizer), T₂ - 100 % RDF, T₃ - 100 % RDF + Two spray of 2 % DAP, T₄ - 100 % RDF + Two spray of 0.4 % Nano DAP, T₅ - 75 % RDF + Two spray of 2 % DAP, T₆ - 75 % RDF + Two spray of 0.4 % Nano DAP, T₇ - 75 % RDF + One spray of 2 % DAP @ 30 DAS + One spray of 0.4 % Nano DAP @ 45 DAS and T₈ - 75 % RDF + One spray of 0.4 % Nano DAP @ 30 DAS + One spray of 2 % DAP @ 45 DAS. The recommended dose of fertilizer 90:45:45 NPK kg ha⁻¹ was applied as per treatments. The result revealed that the growth and yield attributes of sunflowers were influenced significantly due to the different treatments. Application of 100 % RDF + Two spray of 0.4 % Nano DAP (T₄) recorded significantly highest growth and yield attributes *viz.* plant height (199.33 cm), number of functional leaves plant⁻¹ (31.23), leaf area plant⁻¹ (63.87 dm²), stem girth plant⁻¹ (8.57 cm), head diameter plant⁻¹ (18.74 cm), dry matter accumulation plant⁻¹ (133.52 g), number of filled seeds plant⁻¹ (972), test weight (65.81 g), seed yield plant⁻¹ (41.27 g), seed yield (2443 kg ha⁻¹), stalk yield (4895 kg ha⁻¹), oil yield (834 kg ha⁻¹), being at par with the application of 100 % RDF + Two spray of 2 % DAP (T₃) over rest of the treatments. The highest gross monetary returns (1,77,826 ₹ ha⁻¹), net monetary returns (1,22,343 ₹ ha⁻¹), and B: C ratio (3.21) were recorded with the application of 100 % RDF + Two spray of 0.4 % Nano DAP (T₄) over other treatments.

Keywords: Sunflower, RDF, DAP, nano DAP, foliar spray

Effect of soil and foliar application of micronutrients on growth and yield of sunflower (*Helianthus annuus* L.) during pre-rabi season

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ABSTRACT

A field trial was conducted during the pre-rabi, 2024, at Experimental Farm, Agronomy section, ATS, Latur, to evaluate the effect of soil and foliar application of micronutrients on growth and yield of sunflower (*Helianthus annuus* L.) The experimental field was laid out in a Randomized Block Design (RBD) with eight treatments replicated three times. The treatments were T₁- Control, T₂- 100 % RDF (90:45:45 kg NPK kg/ha), T₃- RDF + soil application of ZnSO₄ @ 25 Kg/ha, T₄- RDF + soil application of Borax @ 5 Kg/ha, T₅- RDF + foliar application of 0.5% ZnSO₄ at head formation, T₆- RDF + foliar application of 0.2% Borax at head formation, T₇- RDF + soil application of ZnSO₄ @ 25 Kg/ha + Borax @ 5 Kg/ha and T₈- RDF + foliar application of 0.5% ZnSO₄ + 0.2% Borax at head formation. The results depicted that the growth and yield components of sunflower were influenced significantly due to the application of various treatments. The application of treatment RDF + soil application of ZnSO₄ @ 25 Kg/ha + Borax @ 5 Kg/ha (T₇) showed significantly highest growth attributes viz. plant height (202.16 cm), number of functional leaves plant⁻¹ (28.90), leaf area plant⁻¹ (61.44 dm²), total dry matter accumulation (118.34 g), stem girth plant (8.91 cm) and head diameter (19.83 cm) and was significantly superior over rest of the treatments except for T₈. Highest yield attributes viz. number of filled seeds plant⁻¹ (888), test weight (51.04 g), seed yield plant⁻¹ (48.10 g), seed yield (1974.61 kg ha⁻¹), stalk yield (3434.33 kg ha⁻¹), biological yield (5408.94 kg ha⁻¹) and harvest index (36.51 %) were recorded by the application of treatment RDF + soil application of ZnSO₄ @ 25 Kg/ha + Borax @ 5 Kg/ha (T₇). The highest GMR (140035.61 ₹/ha), NMR (88816.61 ₹/ha), and B: C (2.73) ratio was obtained with the application of treatment RDF + soil application of ZnSO₄ @ 25 Kg/ha + Borax @ 5 Kg/ha (T₇).

Keywords: Sunflower, Micronutrients, Zinc-Sulphate, Borax, Soil Application, Foliar Application

Effect of pre- and post-emergence herbicides on growth and yield of soybean (*Glycine max* L.)

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ABSTRACT

The field experiment was carried out during the *kharif* season of 2024 at the Experimental Farm of Agronomy Section, College of Agriculture, Latur, to study the response to pre- and post-emergence herbicides on the growth and yield of soybean. The soil was clayey in texture, low in available nitrogen (125.44 kg ha⁻¹), low in available phosphorus (9.21 kg ha⁻¹), very high in available potassium (1045.60 kg ha⁻¹), and moderately alkaline nature (pH 7.68) nature. The experiment was laid out in a randomized block design with three replications and seven treatments. The treatments were T₁ – Pendamethalin 38.7 % CS @ 677.25 g a.i/ha (PE), T₂ – Metribuzin 70% WP @ 0.525 kg a.i/ha (PE), T₃ – Metribuzin 70% WP @ 0.525 kg a.i/ha (PoE), T₄ – Propaquizafop 2.5% + Imazethapyr 3.75% w/w ME, T₅ – Fomesafen 11.1% + Fluazifop-butyl 11% W/W SL @ 250 g a.i/ha, T₆ – Weed-free (Two hand weeding), T₇ – Weed check (control). The results showed that the highest plant height (56.77 cm), leaf area plant⁻¹ (6.15 dm²), dry matter plant⁻¹ (20.20 g), no. of pods plant⁻¹ (41.07), seed yield plant⁻¹ (5.05 g), seed yield ha⁻¹ (2882.24 kg) were recorded with weed free treatment (T₇) which was at par with the application of Propaquizafop 2.5% + Imazethapyr 3.75% w/w ME (T₄) and Fomesafen 11.1% + Fluazifop-butyl 11% W/W SL @ 250 g a.i/ha (T₅). These treatments were found significantly superior to the rest of the treatments. **However**, Metribuzin 70% WP @ 0.525 kg a.i/ha (PE) (T₂) and Metribuzin

70% WP @ 0.525 kg a.i/ha (PoE) (T₃) exhibited moderate to severe phytotoxicity symptoms (rating 6–7), which adversely affected plant growth and resulted in lower seed yields of 829.82 kg/ha and 782.34 kg/ha, respectively.

Keywords: Weed management, Soybean Phytotoxicity, Pendamethalin, Metribuzin, Propaquizafop, Imazethapyr, Fomesafen, Fluzifop-butyl

Effect of nano urea and nano DAP on growth, yield, and quality of soybean [*Glycine max* (L.) Merrill]

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ABSTRACT

A field experiment was conducted during *Kharif* 2024 at the Experimental Farm, Agronomy Section, College of Agriculture, Latur, to study the effect of nano urea and nano DAP on the growth, yield, and quality of soybean (*Glycine max* (L.) Merrill). The experimental soil was clayey in texture, moderately alkaline (pH 7.4), low in available nitrogen (112.9 kg ha⁻¹), medium in phosphorus (7.46 kg ha⁻¹), and high in potassium (1145.60 kg ha⁻¹), with good drainage and uniform topography. The experiment was laid out in a Randomized Block Design with eight treatments replicated thrice. The treatments were T₁- Control (No fertilizer), T₂ - 100% RDF (30: 60: 30 NPK Kg ha⁻¹), T₃ - 100% RDF + two sprays of Nano Urea at 30 DAS and 45 DAS, T₄ -100% RDF + two sprays of Nano DAP at 30 DAS and 45 DAS, T₅ - 75% RDF + two sprays of Nano Urea at 30 DAS and 45 DAS, T₆ - 75% RDF + two sprays of Nano DAP at 30 DAS and 45 DAS, T₇ - 75% RDF + one spray of Nano Urea at 30 DAS and one spray of Nano DAP at 45 DAS, T₈ -75% RDF + one spray of Nano DAP at 30 DAS and one spray of Nano Urea at 45 DAS. The results revealed that application of 100% RDF + two sprays of Nano Urea @ 30 DAS and @ 45 DAS (T₃) recorded highest growth attributes viz. plant height (66.71 cm), number of functional leaves (19.43), branches per plant (9.23), leaf area (6.31 dm²), and dry matter accumulation (43.24 g). T₃ also recorded the highest yield attributes viz. number of seeds pod⁻¹ (3.1), number of seeds plant⁻¹ (173.8), Seed yield plant⁻¹ (16.57 gm), seed index (12.51), grain yield (3286 kg ha⁻¹), straw yield (5351 kg ha⁻¹), biological yield (8637 kg ha⁻¹) and harvest index (38.08%). Economic analysis also showed that application of 100% RDF + two sprays of Nano Urea @ 30 DAS and @ 45 DAS (T₃) gave the highest gross monetary returns (₹161014 ha⁻¹), net monetary returns (₹104568 ha⁻¹), and benefit-cost ratio (2.9).

Keywords: Soybean, RDF, Nano Urea, Nano DAP, and Foliar Application

Periodical changes in Radiation Use Efficiency at Different Growth Stages of soybean

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ABSTRACT

An experiment was conducted during *Kharif* 2024 at the Research Farm of the Department of Agricultural Meteorology, VNMKV, Parbhani, to evaluate the influence of different sowing dates and soybean varieties on growth, yield, and phenology. The study was laid out in a split-plot design with four sowing dates (25th SMW, 26th SMW, 27th SMW & 28th SMW) and three varieties (MAUS-158, MAUS-162, JS-335). Early sowing (D₁) significantly enhanced growth parameters, including plant height (25.06 cm), leaf area index (2.5), and dry matter accumulation (17.29 g plant⁻¹). Grain yield was

highest in D₁ (1969.1 kg ha⁻¹) and decreased with delayed sowing. MAUS-158 is superior compared to other varieties with maximum yield (1608.8 kg ha⁻¹) and uses more RUE (2.40 kg MJ⁻¹) and PAR interception was highest under early sowing and in MAUS-158, indicating efficient use of thermal and radiation resources. Reflected PAR was lowest in MAUS-158, indicating efficient radiation absorption. Results highlight that early sowing in the 25th SMW with MAUS-158 optimizes growth, yield, and RUE under semi-arid rainfed conditions. This study emphasizes the importance of strategic sowing time and varietal choice for maximizing soybean productivity through improved radiation and thermal resource management.

Keywords: Soybean, PAR, Radiation use efficiency, Dates of sowing, and Varieties

Growing Degree Days by different methods for the Parbhani location in the Rabi Sorghum crop

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ABSTRACT

The present study was conducted at the research farm of the Department of Agricultural Meteorology, Vasant Rao Naik Marathwada Krishi Vidyapeeth, Parbhani, to examine the Effect of thermal regimes on rabi sorghum (*Sorghum bicolor* L.) varieties. The experiment followed a split-plot design with three replications. Three sowing dates were evaluated: D₁ (42nd SMW), D₂ (43rd SMW), D₃ (44th SMW). The study involved four sorghum varieties: V₁ - Dagadi, V₂ - Parbhani Moti, V₃ - Parbhani Super Moti, and V₄ - Parbhani Shakti. The crop was sown at a spacing of 45 × 15 cm, and the net plot size for each treatment was 4.5 × 2.1 m². Computation of Growing Degree Days by different methods for Parbhani location in Rabi Sorghum crop. Based on C.V. values of different 8 methods were examined it was found that method 1: Standard Degree Day method and method 5 : (method 1 × DL/12) recorded the least C.V. for all the varieties across the sowing dates. Hence, for further analysis of GDD method 1: Standard Degree Day method and method 5 : (method 1 × DL/12) found suitable for Parbhani location for rabi sorghum crop.

The highest Growing Degree Days (GDD) was observed on first date of sowing D₁, followed by D₂ and D₃ respectively. Among the varieties highest GDD was reported Parbhani Moti followed by Parbhani Super Moti and Dagadi. Lowest total accumulate was in Parbhani Shakti.

Keyword: Sorghum, Growing degree day, Varieties, Date of Sowing

Radiation Use Efficiency and Growth Performance of Pigeon Pea (*Cajanus cajan* L.) Under Rainfed Conditions

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ABSTRACT

A research experiment was conducted in *Kharif* 2024-25 at Research farm AICRP Agrometeorology, Vasant Rao Naik Marathwada Krishi Vidyapeeth, Parbhani to study radiation use efficiency on pigeon pea with respect to different dates of sowing and varieties during *Kharif* season. The field experiment was laid out in a split plot design with three replications. There were 12 treatment combinations comprising of four sowing dates viz., D₁ (25th SMW), D₂ (26th SMW), D₃ (27th SMW) and D₄ (28th SMW) as main plot treatments and three varieties viz., V₁ (BDN-711), V₂ (BDN-716) and V₃ (GODAVARI) as sub plot treatments. It was found that D₁ (25th SMW) gave significant results in photosynthetically active radiation (PAR), radiation use efficiency (RUE), yield and yield components which were due to efficient

GDD than other dates of sowing. Similarly, variety V₂ (BDN-716) performed significantly better than V₁ (BDN-711) and V₃ (Godavari) in yield and radiation use efficiency.

The highest RUE was recorded in D₁ (4.50 kg ha⁻¹ MJ⁻¹), while the lowest value was observed in D₄ (1.46 kg ha⁻¹ MJ⁻¹). Among the varieties, V₂ (BDN-716) showed the highest RUE (4.14 kg ha⁻¹ MJ⁻¹), whereas V₃ (Godavari) recorded the lowest (3.93 kg ha⁻¹ MJ⁻¹). These findings reflect significant interactions between crop physiology, phenology and prevailing environmental conditions.

Results highlight that early sowing in the 25th SMW with BDN-716 optimize growth, yield, and RUE under semi-arid rainfed conditions. This study emphasizes the importance of strategic sowing time and varietal choice for maximizing soybean productivity through improved radiation and thermal resource management.

Keywords: Photosynthetically active radiation (PAR), Radiation use efficiency (RUE), Pigeon pea varieties, dates of sowing

Phenological studies on Pigeon pea cultivars under varied weather environment

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ABSTRACT

Present investigation during the academic year 2024–25, a study was conducted at the Department of Agricultural Meteorology, College of Agriculture, Vasant Rao Naik Marathwada Krishi Vidyapeeth, Parbhani. To investigation were, to assess the phenological studies on Pigeon pea cultivars under varied weather environment and effect of weather parameters on growth, development and yield of Pigeon pea, to prepare crop weather calendar of Pigeon pea. Long term data from 2015-2024 use for this study. Collection of data from AICRP on Agrometeorology, VNМКV, Parbhani. During this period, the mean maximum temperature reached up to 31.4 °C, while the minimum dropped to 19.0 °C. Mean annual rainfall was also variable, with the highest recorded value being 945.7 mm.

During the phenological assessment of pigeon pea, it was observed that the transition from emergence to the seedling stage required the longest duration, spanning approximately 25 to 29 days. In contrast, the shortest interval was recorded as 5 to 8 days between sowing and emergence. Phenological analysis revealed that the longest duration was recorded between the branching and flowering stages, spanning approximately 69 to 77 days. Additionally, the highest mean maximum temperatures, ranging from 33.4 °C to 39.2 °C, were observed during the pod formation to grain formation stage. Correspondingly, the highest mean minimum temperature, varying between 12.5 °C and 18.4 °C, was recorded from grain formation to physiological maturity.

In the assessment of agrometeorological indices for pigeon pea, the highest values of Growing Degree Days (GDD), Helio-Thermal Units (HTU), and Photo-Thermal Units (PTU) were recorded during the 2015-2024 cropping season, accumulating 4250.5 °C days, 25747.2 °C Day-hours, and 51005.5 °C Day-hours, respectively over the span of 23 SMW to 02 SMW. Among the various sowing schedules, the early sowing date D₁ (25th SMW) recorded the maximum accumulation of thermal units, indicating its potential advantage for crop development under prevailing agroclimatic conditions.

Keyword: Phenological stages, Pigeon pea, Cultivars, Agrometeorological indices

Digital Technologies for the Elderly in Natural Disasters**Soumya Kammar***Human Development and Family Studies, College of Community Science, Assam Agricultural University, Jorhat, Assam, India***ABSTRACT**

Climate emergencies, such as floods, heatwaves, droughts, and cyclones, pose significant threats to elderly populations due to their age-related vulnerabilities, limited mobility, chronic health conditions, and social isolation. In this context, digital and assistive technologies have emerged as vital tools to enhance resilience, ensure safety, and support the well-being of older adults before, during, and after climate-induced disasters. This chapter explores how various technologies can be harnessed to address the unique needs of elderly individuals during climate emergencies. Technologies such as wearable health monitors, GPS-enabled alert devices, early warning mobile applications, AI-driven voice assistants, telehealth platforms, and climate-adaptive assistive devices are increasingly being employed to monitor vital signs, issue timely alerts, enable real-time communication, and provide emergency support. Community-based digital platforms also facilitate social connectedness, access to resources, and coordination of care, particularly for those living alone or in remote areas.

The importance of these technologies lies not only in their ability to reduce physical risks and psychological distress among older adults but also in their potential to empower them with autonomy and dignity during crises. Furthermore, integrating technology into disaster management strategies can inform inclusive policy-making. It enables policymakers to design age-sensitive disaster response systems, strengthen early warning dissemination frameworks, and allocate resources efficiently. By showcasing current innovations, global practices, and context-specific adaptations, this chapter underlines the need for collaborative efforts between technologists, gerontologists, policymakers, and community stakeholders to ensure that technology becomes a bridge, not a barrier, for elderly resilience. The insights provided can contribute to the development of inclusive, tech-driven frameworks that prioritize elderly needs in climate crisis management and long-term adaptation planning.

Keywords: Digital Technologies, Assistive Technologies, Resilience, Elderly, Climate Emergencies

Space Applications: Remote Sensing and GIS in Climate Change Impacts and Solutions**Ankita Khakhal***Department of Agricultural Extension and Communication, SKARU, Bikaner, (Rajasthan)***ABSTRACT**

One of the biggest problems of the twenty-first century is climate change, which has an impact on ecosystems, weather patterns, agriculture, and human lifestyles worldwide. Technologies based in space, especially Geographic Information Systems (GIS) and remote sensing, are essential for comprehending, tracking, and mitigating the complex effects of climate change. Data on a range of environmental factors, including temperature anomalies, sea level rise, glacial retreat, deforestation, and shifts in land use and vegetation cover, can be consistently and instantly collected thanks to remote sensing. The detection of extreme weather occurrences and long-term climate changes depends on these data. By offering strong capabilities for spatial analysis, data integration, and visualization, GIS enhances remote sensing. When combined, they make it easier to model climate scenarios, evaluate risks, and create efficient adaptation and mitigation plans. Applications include analyzing agricultural susceptibility, managing water resources, tracking greenhouse gas emissions, and assisting with climate-resilient urban design. Policymakers, researchers, and disaster management authorities can make well-informed judgments by combining satellite data with geospatial analysis. In addition to improving our

knowledge of climate dynamics, these technologies support national and international efforts to accomplish the Sustainable Development Goals (SDGs) and create a future that is climate resilient.

Keywords: - Climate Change, Geographic Information Systems, Sustainable Development Goals, Remote Sensing, Weather.

Climate Change and Its Impacts on Nutrition and Food Security in India

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ABSTRACT

Global food systems are seriously threatened by climate change, and developing countries like India are especially at risk because of their heavy reliance on climate-sensitive agriculture. In the Indian context, this study looks at the intricate relationships that exist between climate change, agricultural productivity, and nutritional outcomes. In addition to decreasing crop yields, rising temperatures, unpredictable rainfall patterns, and an increase in the frequency of extreme weather events are also having an impact on the nutritional value of staple foods like rice, wheat, and pulses. For example, higher CO₂ (carbon dioxide) levels have been associated with lower grain protein and micronutrient content, which exacerbates malnutrition in populations that are already at risk.

Additionally, socioeconomic factors like poverty, gender inequality, and a lack of public health infrastructure are making it harder to be resilient to food insecurity and undernutrition. This paper also assesses the projected nutritional implications under various climate scenarios using data from national and international databases. Policy gaps and adaptation challenges are discussed, with a focus on promoting climate-resilient crops, sustainable agricultural practices, and nutrition-sensitive food policies. Climate-induced soil degradation and water scarcity are also reducing the efficiency of food production systems, which affects food availability, accessibility, and affordability.

The results show that in order to guarantee long-term food and nutritional security in India, a multidisciplinary strategy combining climate science, agronomy, and public health is desperately needed. This study intends to assist policymakers in creating comprehensive mitigation and adaptation plans specific to the Indian context by highlighting the cascading effects of climate change on food systems.

Keywords: Climate change; Climate-sensitive Agriculture; Food Security; Nutrition; Sustainable agriculture; Climate science; Soil degradation; Climate-resilient crops; Agronomy; Public health;

Workplace Well-Being as a Preventive Health Strategy: A conceptual review from an HRM perspective

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ABSTRACT

In today's environment, employee well-being is a crucial aspect that organizations must prioritize and integrate to enhance overall performance and success. This review paper investigates the significance of workplace well-being programs in enhancing employee health and supporting organizational culture. It also demonstrates the different types of well-being initiatives and their long-term impact on both employees and organizations. Supporting the review's findings, the inclusion of JD-R and COR theories offers a valuable perspective on how well-being initiatives influence employee performance and commitment towards the organization. The review further emphasizes the importance of regularly assessing and gaining a clear understanding of employee needs. Additionally, the review discusses how workplace well-being initiatives can function as a preventive health strategy to reduce health-related

risks and promote long-term wellness. This review paper includes 30 latest peer-reviewed articles offering a comprehensive analysis of workplace well-being initiatives.

The paper outlines practical implications for HR professionals. Additionally, it highlights the importance of a healthy workforce in contributing to organizational goal achievement and enhanced productivity. Future research direction has suggested investigating the long-term benefits of these programs, particularly within multidisciplinary contexts and public sector settings.

Keywords: Employee Well-Being, Workplace Program, Productivity, Preventive Health Strategy, Organizational Success

Recycled Concrete Aggregate in Building Construction: A Comparative Life Cycle Assessment and Modeling of Performance

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ABSTRACT

Concrete is the most widely used construction material globally, leading to significant consumption of natural resources and the generation of demolition waste. Recycled Concrete Aggregate (RCA), derived from crushed concrete structures, offers a promising sustainable alternative. This paper investigates the use of RCA in building construction, focusing on a comparative life cycle assessment (LCA) and modeling of performance relative to conventional concrete incorporating natural aggregates (NA). The study analyzes the environmental impacts associated with the production, transportation, construction, operational lifespan, and end-of-life stages of both RCA and NA-based concrete buildings. Furthermore, performance characteristics like strength, durability, and long-term behavior are modeled to assess the impact of RCA on structural integrity and overall service life. The findings highlight the potential environmental benefits of RCA, particularly in resource depletion and waste reduction. However, the performance modeling reveals potential trade-offs that necessitate careful material selection, mix design optimization, and appropriate structural design considerations to ensure the long-term performance and sustainability of RCA-based buildings.

Keywords: Recycled Concrete Aggregate (RCA), Life Cycle Assessment (LCA), Building Construction, Sustainable Construction, Performance Modeling, Durability, Natural Aggregate (NA)

Harnessing the Carbon Sink Potential of Urban Trees for Ecological and Climate Resilience in Cities

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ABSTRACT

Climate change has become a global concern with far-reaching environmental and socioeconomic consequences. Urban areas, experiencing rapid and often unplanned development, face rising temperatures, erratic rainfall, and increased frequency of extreme weather events. These conditions, coupled with the transformation of natural landscapes into densely built environments, have intensified the urban heat island effect and deteriorated ecological balance. Amidst these challenges, urban trees emerge as critical components of *green infrastructure*, providing essential *ecosystem services* such as *carbon sequestration*, air purification, and thermal regulation.

Despite the well-documented role of forest ecosystems in the global *carbon cycle*, the contribution of *urban trees* to *carbon storage* has received limited attention. This study aims to assess the *carbon sequestration potential* of urban vegetation through *biomass estimation* techniques involving species identification and field-based measurements like *diameter at breast height (DBH)* and tree height. The

findings emphasize the need for strategic tree selection that not only supports *biodiversity* but also maximizes carbon absorption.

Recognizing urban vegetation within climate policy frameworks, such as potential post-Kyoto initiatives, could enhance public awareness and support sustainable city planning. Integrating scientifically informed tree management into urban design is essential to mitigate climate impacts and foster resilient, low-carbon cities.

Keywords: Urban trees, Carbon sequestration, Biomass estimation, Urbanization, Green infrastructure, Ecosystem services, Sustainable cities

Living Fabrics: Merging Biotechnology with Fashion Innovation

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ABSTRACT

The convergence of bioscience and fashion marks a transformative shift toward sustainability, innovation, and personalization in the textile and apparel industries. This interdisciplinary approach combines biological systems, biotechnology, and materials science with design thinking to create environmentally friendly fabrics, bio-based dyes, and garments that respond to physiological or environmental cues. Innovations such as lab-grown leather, biodegradable textiles, mycelium-based materials, and microbial dyeing processes not only reduce the ecological footprint of the fashion industry but also reshape traditional manufacturing practices. Furthermore, bioscience enables the development of adaptive or living clothing that can regulate temperature, release fragrance, or even grow with the wearer. These advancements highlight the potential of merging bioscience with fashion to tackle global challenges such as textile waste, pollution, and resource depletion, while opening new creative and commercial opportunities. As consumer demand for ethical and sustainable fashion increases, integrating bioscience offers a viable path toward a regenerative and circular fashion economy.

Keywords: Biotechnology; fashion; material science; biological science

From Classrooms to Climate Action: Educating for a Greener Tomorrow

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ABSTRACT

Climate literacy has become a vital part of education in the 21st century as the world struggles with the rising effects of climate change. Incorporating climate education into school and college curricula promotes informed citizenship, critical thinking, and responsible decision-making. It provides students with the knowledge, skills, and values necessary to understand climate science, recognize the social, economic, and environmental impacts of climate change, and take sustainable actions both locally and globally. This interdisciplinary approach combines science, policy, ethics, and innovation, encouraging young learners to participate in climate solutions through project-based learning, green campus initiatives, and community outreach. Despite increasing awareness, climate education often remains scattered or missing in many institutions due to limited resources, a lack of trained teachers, or insufficient policy support. Enhancing climate literacy in formal education systems is essential for developing a resilient, climate-conscious generation capable of contributing to a fair and sustainable future.

Keywords: Climate Literacy; Environmental Education; Sustainability; Youth Empowerment; Curriculum Development.

Quantifying cyclonic influence on rainfall through optimal distance estimation using non-parametric test

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ABSTRACT

Tropical cyclones (TC) are considered the most destructive hydro meteorological disaster and Tamil Nadu experiences more instances of cyclones in the Bay of Bengal than other regions, partly due to its position. Cyclones are often associated with torrential rainfall, resulting in flooding and a rainfall is termed to be cyclonic rainfall if it falls within a specific distance between the TC center and the station. Various studies used an array of distance ranging from 100 to 1100 km and it varies from region to region. Thus, the current study was conducted to find the optimum distance for a rainfall event to be considered as cyclonic rainfall. The Kruskal-Wallis's test is used to identify whether significant relationship exist among distance ranges (0-100 to 901-1000 km) and followed by dunn's multiple comparison test to determine which group is significant. Rainfall data is collected from Public Works Department, Taramani, Chennai for 336 rain gauge stations over Tamil Nadu for a period 1991-2023. Among the distance ranges, the highest median rainfall of 35.4 mm is observed in the closer distance range of 0-100 km, followed by 101-200 km (18.2 mm). Kancheepuram is found with the highest median rainfall of 113.3 mm among the districts in 0-100 km. In 0-100 km range, a single day maximum rainfall of 375.1 mm is recorded in Mayiladuthurai. However, the highest one day maximum is observed in the same Mayiladuthurai over 201-300 km range. Dunn test also confirmed that the rainfall beyond 500 km is found to be non-significant, with distance ranges from 0-100 to 401-500. These historical findings underscore the importance of this analysis for informed disaster preparedness, water management, and climate-resilient agricultural planning.

Keywords: Tropical cyclone, Bay of Bengal, Rainfall, Distance, Kruskal-Wallis' test

Impact of thermal stress on biological parameters of *Chrysoperla zastrowi sillemi* (Esben Petersen) Rajareddy G¹, Shashikala, M¹, Jayanth, BV¹, Udaykumar E¹ and Bishwajeet Paul*

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ABSTRACT

Aphid lions (*Chrysoperla zastrowi sillemi*, Esben-Petersen) are important predators in integrated pest management for field crops and vegetables (Neuroptera: Chrysopidae). It is found in almost every environment on Earth, with the exception of temperate ones. One of the most significant environmental variables influencing an insect species' rate of growth is temperature. Five consistent temperatures were

observed: 20 ± 1 °C, 25 ± 1 °C, 30 ± 1 °C, 35 ± 1 °C, and 40 ± 1 °C. The impact of temperature on biological parameters and developmental phases of Aphid lions feeding on rice moth eggs was noted. The development time of *C. zastrowi sillemi* was found to be 47.26 days at 20°C and 22.18 days at 40°C. The lifespan of adult males and females was more than twice as long at the lower temperature range as it was at the higher one. The temperature of 25°C produced greatest duration of oviposition (55.12 days), the highest percentage of pupals (91.43%) and adults emergence (90.25%), the maximum fecundity (903.33 eggs/female), and the maximum degree of hatchability (90.84%) of eggs, suggesting that this temperature regime was more suited for the *C. zastrowi sillemi* that originated in Delhi. The results demonstrate significant variations in the developmental cycle of the immature stages at five distinct temperatures, with a negative association between temperature increase and developmental duration.

Keywords: Green lacewing, biological parameters, Immature Stages, Temperature.

Documentation And Characterisation Of Malbhog And Chinia Banana Varieties Of Bihar.

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ABSTRACT

Banana is a tree-like perennial herb that is prized for its nutritional values. Due to its year-round availability and rich source of nutrients, it is considered an important fruit of Bihar. In Bihar, indigenous varieties like Malbhog and Chinia have been cultivated for generations and are naturally adapted to the agroclimatic conditions of Bihar. Bihar harbours a rich diversity of indigenous banana varieties, many of which remain undocumented despite their regional importance. Malbhog and Chinia are distinct traditional banana varieties cultivated for their unique agronomic traits. This study attempts to characterise the morphological characteristics of these varieties. Discussion with the farmers and field surveys were conducted to observe various varietal traits. These dessert banana varieties showed variations in plant height, pseudostem thickness, fruit apex, finger drop, fruit cracking, and bunch appearance. Due to the rising cultivation of tissue-cultured Grand Naine banana and the lack of good planting material, these varieties face declining cultivation. Therefore, in order to conserve these varieties, proper documentation and characterisation are needed that can strengthen agrobiodiversity and sustainable agriculture.

Keywords: indigenous varieties, Malbhog, Chinia, characterisation, documentation.

Isolation and characterization of halophilic PGPR *Bacillus licheniformis* AUSTB01.

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ABSTRACT

Environmental stresses such as high temperature, drought, pH, and salinity impose a significant challenge in maintaining crop growth and productivity. Hyper-saline conditions hurt soil porosity and water availability. Salinity also limits physiological processes like photosynthesis, respiration, and plant nutrition, which leads to reduced nutrient uptake by plants, poor seed germination, and restricted stomatal opening, thereby suppressing overall plant growth and development. In order to overcome these drawbacks, some favorable and beneficial microorganisms, particularly known as plant growth-promoting rhizobacteria (PGPR), can be introduced into saline soil. The present study is associated with the isolation and characterization of halotolerant PGPR. A total of 28 bacterial morphotypes were isolated through serial dilution of the soil sample and were then screened for their halotolerance potency. Among these isolates, AUSTB01 demonstrated the highest level of halotolerance, surviving in 10% salt.

Based on phenotypic, biochemical, and genotypic characterization via 16S rRNA sequencing, the bacterial isolate was identified as *Bacillus licheniformis* AUSTB01 (Accession no. PV760345.1). This strain demonstrated positive results for plant growth-promoting (PGP) traits like N₂ fixation (20.81 µg ml⁻¹), P solubilization (52.50 mg l⁻¹), IAA (21.18 µg ml⁻¹ in Trp⁺ and 10.64 µg ml⁻¹ in Trp⁻), GA (594.86 µg ml⁻¹), siderophore (79.39 SU%), and NH₃ (11.04 µg ml⁻¹). Also, positive results were observed for other PGP traits like K solubilization, CMC degradation, and HCN production, signifying its potential as an effective plant growth promoter, enhancing the growth and yield of plants.

Keywords: *Bacillus licheniformis* AUSTB01, PGPR, halotolerance, isolation.

Bioremediation by selected *Bacillus* strains

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ABSTRACT

Heavy metal contamination in soil and water due to industrial discharge, mining, and agricultural runoff has become a pressing global environmental issue. These metals not only degrade the quality of ecosystems but also pose serious health risks to humans and animals. Microbial bioremediation is emerging as a promising strategy, especially using native or resistant bacterial strains capable of tolerating and detoxifying multiple heavy metals. The present study investigates and compares the metal degradation capacities of four selected *Bacillus* strains-AUPPB01, AUPPB02, AUPPB07, and AUPPB10- against Zinc (Zn), Manganese (Mn), Lead (Pb), Cobalt (Co), and Mercury (Hg).

The results indicated varying resistance levels among the strains. All four strains showed moderate tolerance toward Zn, suggesting a common adaptive trait across the selected bacteria. For Mn, AUPPB01 exhibited the highest tolerance, followed by AUPPB02 and AUPPB07 as moderate, while AUPPB10 showed no tolerance at all, indicating a strain-specific trait. In the case of Pb, AUPPB07 showed the strongest resistance and degradation, making it a potential candidate for Pb remediation, whereas AUPPB10 and AUPPB02 showed moderate resistance, while AUPPB01 had the least efficacy. Co-tolerance was highest in AUPPB07, moderate in AUPPB02, less in AUPPB01 (+), and completely absent in AUPPB10 (-). Interestingly, Mercury (Hg) resistance was found exclusively in AUPPB01 (+++), while all other strains lacked any zone of tolerance, showing complete sensitivity (-) to this toxic metal.

This comparative analysis highlights that AUPPB07 stands out as the most versatile strain, demonstrating excellent resistance to both Lead and Cobalt and moderate resistance to Zinc and Manganese. AUPPB01 is especially significant for Manganese and Mercury resistance, offering niche bioremediation applications where Hg contamination is present. AUPPB02 offers a broader but weaker spectrum of tolerance, while AUPPB10 shows the least potential, with resistance limited to Zinc and Lead.

The consequences of these findings suggest that the strategic application of selected *Bacillus* strains could significantly improve the bioremediation of multi-metal contaminated sites. AUPPB07 and AUPPB01, in particular, should be further explored for their potential in site-specific bioremediation projects. Future studies should investigate their genetic and enzymatic mechanisms of resistance and test their performance under real-world environmental conditions.

Keywords: Bioremediation, *Bacillus* strains, Heavy metal tolerance, environmental pollution, Microbial detoxification.

Comparative study of Plant Growth Promoting traits of selected *Bacillus* strains

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ABSTRACT

Plant Growth-Promoting Rhizobacteria (PGPR) are gaining global recognition as eco-friendly alternatives to chemical fertilizers and pesticides due to their multifaceted roles in enhancing soil fertility, promoting plant growth, and providing protection against phytopathogens. The present study provides a comparative qualitative assessment of major plant growth promoting (PGP) traits, including nitrogen (N₂) fixation, phosphorus (P) and potassium (K) solubilization, production of phytohormones such as indole-3-acetic acid (IAA) and gibberellic acid (GA), ammonia, siderophore and hydrogen cyanide (HCN) production and carboxymethyl cellulose (CMC) degradation. The present study aimed to study the comparative PGP traits of selected *Bacillus* strains, namely, *Bacillus licheniformis* AUSTB01, *Bacillus cereus* AUPPB10, and *Bacillus velezensis* AUPPB07. Among the three strains, AUSTB01 demonstrated the most favourable outcomes, followed by AUPPB10, while AUPPB07 yielded the least effective results. This trend was followed for most of the traits studied, except hydrogen cyanide (HCN) production and siderophore activity, where the results differed. The PGP traits, such as N₂ fixation and NH₃ production, signify their contribution to soil nitrogen enrichment. *B. licheniformis* showed strong P and K solubilization, indicating its effectiveness in mobilizing essential nutrients, production of phytohormones like IAA and GA, emphasising its potential role in enhancing plant growth. All tested strains exhibited strong siderophore production and HCN activity, showing their biocontrol activity against soil-borne pathogens via iron sequestration and antagonistic effects. CMC degradation was observed in each strain, confirming their cellulolytic capabilities, which may aid in organic matter decomposition and improve soil structure. This comparative study emphasizes the multifaceted role of these *Bacillus* strains as potential biofertilizers and biocontrol agents in a sustainable crop management system.

Keywords: PGPR, Indole-3-acetic acid, Hydrogen cyanide, *Bacillus*.

Biostimulatory role of *Bacillus licheniformis* AUSTB01 in barley under salt stress conditions

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ABSTRACT

The present study aimed to evaluate the potential of *Bacillus licheniformis* AUSTB01 under varying salt concentrations (0.5%, 1.5% and 3%) to understand their impact on barley (*Hordeum vulgare* L.). Plants were treated with bacterial inoculants and compared with non-inoculated controls across these salt levels. The experiment focused on key growth parameters, including root length, shoot length, and overall biomass. The findings indicate that bacterial treatment positively influenced plant growth, particularly at lower salinity levels (0.5% and 1.5%), where increases in root length, shoot length, and biomass were recorded in comparison to untreated controls. At a higher salt level (3%), although stress effects became more pronounced, inoculated plants still outperformed non-inoculated ones, suggesting that the bacteria helped mitigate salt-induced damage. The highest recorded values for root, shoot, and biomass are 13.36 cm, 16.15 cm, and 0.94 g, respectively, and were observed at 0.5% salinity. These results suggest that *B. licheniformis* AUSTB01 can play a key role in enhancing plant tolerance to salinity, offering promising strategies for improving crop resilience in salt-affected soils.

Keywords: *Bacillus licheniformis* AUSTB01, Salinity, Bacterial inoculants, Barley

Probiotics Efficiency of Phytase Producing *Bacillus amyloliquefaciens* AUPPB 02 from Fermented Lentil.**Ushakar Mishra and Abha Singh***Microbial Biodiversity Lab., Department of Botany, Patna University, Patna-800005, Bihar, India***ABSTRACT**

A probiotic is defined as “live microorganisms which when administered in adequate amounts confer a health benefit on the host”. The functional probiotic is supposed to be non-pathogenic, resistant to gastric acid and bile toxicity, able to adhere and colonize to intestinal tissue, and to compete with pathogens, to provide a better immune response. The isolated phytase-producing strains *Bacillus amyloliquefaciens* AUPPB02 (OR187307) were examined for probiotic qualities, following the standard protocols, accepting the *Lactobacillus acidophilus* (MTCC 10307) as a reference probiotic strain. The acid tolerance test of AUPPB02 exhibited 89, 72, and 67 % survival at pH 2 and subsequently, 94.5, 86, and 82 % survival at pH 3 after 1, 2, and 3 h of incubation periods, respectively, which is higher than the reference strain. AUPPB02 shows bile tolerance of 2.0 %, casein and lipid digestibility, non-haemolytic, and non-lecithinase producer. AUPPB02 had more effectiveness, with 133.33 % and 108 %, against tested pathogens (*S. aureus* MTCC 3160 and *P. aeruginosa* MTCC 741), than the reference strain. The antibiotic susceptibility of AUPPB02 and *L. acidophilus*, which reflects that isolated strains were more sensitive than the reference strain, against all test antibiotics (azithromycin, tetracycline, erythromycin, amoxicillin, norfloxacin, and levofloxacin). Thus, it could be concluded that AUPPB02 is potent probiotic than the earlier established probiotic (*L. acidophilus*), after an *in vivo* study on an animal model.

Keywords: *Bacillus amyloliquefaciens* AUPPB02, Probiotics, antibacterial, antibiotic susceptibility, Phytase.

Total Factor Productivity Growth of Black Gram in Maharashtra**Rahane J. J., Muned P. V., and Bhosale P. S.**^{1,2,3}Department of Agricultural Economics, PGI, MPKV, Rahuri-413722, Ahilyanagar, Maharashtra**Purpose**

To assess the Total Factor Productivity (TFP) growth of black gram in Maharashtra from 1991-92 to 2020-21 and evaluate the role of technology and non-input factors in enhancing productivity and sustainable growth. By identifying periods of stagnation or improvement in productivity, the study seeks to understand the role of technological advancements, institutional support, and policy interventions in enhancing black gram productivity. The findings are expected to provide insights for policymakers, researchers, and stakeholders to promote sustainable pulse production and improve resource use efficiency in the state.

Material and Methods

The Tornqvist Theil chained Divisia index approach was applied for the measurement of total factor productivity using output and input data of black gram. This method captures the contribution of multiple inputs, such as human labour, bullock labour, machine labour, seed, manure, fertilizers, plant protection, incidental charges, depreciation, and rental value of land, relative to the growth in crop output, thereby providing a comprehensive measure of productivity improvements. The analysis was grounded in farm-level panel data obtained from the State-funded Cost of Cultivation Scheme, which offers consistent and reliable estimates of yield levels, input usage, and input/output prices. The data spans 30 years from 1991-92 to 2020-21, enabling the study to trace long-term trends and temporal shifts in productivity performance. TFP decomposition was done using log-linear regression on pooled time-series cross-sectional data to identify key factors influencing black gram productivity growth

across regions of Maharashtra. The multi-variable model was utilized to determine the determinants of total factor productivity growth, taking total factor productivity as the dependent variable. Explanatory variables included number of irrigation pump sets (Nos.), number of tractor (Nos.), annual rainfall (mm), rainfall (July-October(mm), road length (km), fertilizer use (kg/ha), proportion of irrigated area to net cultivated area (%) and agricultural credit (Rs.).

Results

From 1991-92 to 2020-21, black gram in Maharashtra showed moderate TFP growth, with a mean index of 1.22 and a TFP share of 14.19%. Peak TFP (1.83) was recorded in 2016-17, despite some years showing a decline. The highest TFP growth occurred in Period III (5.02%) and Period I (4.53%), while Period II saw a decline (-2.88%). Overall, TFP grew marginally at 0.37 per cent per annum. Regression analysis indicated that rainfall, road length, and fertilizer use had significant positive impacts on TFP, while agricultural credit had a negative effect. The model explained 70 per cent of TFP variation, underlining the role of both physical and institutional factors.

Conclusions

The positive TFP share in black gram across all sub-periods and the overall period indicates a notable contribution of non-input factors like technology and improved practices to output growth. For the entire study period, the TFP growth rate in black gram showed signs of stagnation, indicating limited improvements in productivity beyond input use. Annual rainfall, fertiliser use, and road length have a positive and significant impact on total factor productivity, while agricultural credit showed a negative and significant effect on TFP growth on black gram.

Keywords- Black Gram, Tornqvist-Theil Index, Total Factor Productivity, TFP Growth Rate, and Factors.

Leveraging Information Technology for Advanced Climate Research

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ABSTRACT

The integration of Information Technology (IT) and digital tools has revolutionized climate studies by enhancing data collection, modeling, analysis, visualization, and communication of climate-related information. Technologies such as Geographic Information Systems (GIS), remote sensing, big data analytics, artificial intelligence (AI), machine learning, and cloud computing have significantly improved the accuracy and speed of climate forecasting, impact assessments, and risk mapping. These tools enable researchers and policymakers to monitor climate variables in real time, simulate future scenarios, and develop data-driven adaptation and mitigation strategies. Additionally, digital platforms facilitate global collaboration, citizen science initiatives, and effective dissemination of climate knowledge to diverse stakeholders. The application of IT in climate studies not only supports evidence-based decision-making but also plays a vital role in climate communication, early warning systems, and building climate-resilient communities. Highlights the transformative role of digital innovation in addressing the complexities of climate change and underscores the need for continued investment in technological infrastructure and capacity building in climate science.

Keywords: Information Technology; Remote Sensing; Artificial Intelligence; Climate Modeling

Urban Infrastructure Resilience in the Face of Climate Change

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ABSTRACT

As climate change intensifies, urban areas face increasing risks from extreme weather events, sea-level rise, heatwaves, and flooding. Developing climate-resilient urban infrastructure is essential to ensure the sustainability, safety, and functionality of cities in the face of these challenges. This involves integrating adaptive design principles, green infrastructure, nature-based solutions, and smart technologies into urban planning and development. Strategies such as permeable pavements, green roofs, flood-resistant buildings, early warning systems, and resilient transport networks are critical to enhancing urban adaptive capacity. Moreover, inclusive planning that considers the socioeconomic vulnerability of urban populations ensures equitable resilience. This highlights the importance of forward-thinking policies, interdisciplinary collaboration, and innovative engineering solutions in building urban infrastructure capable of withstanding the adverse impacts of climate change.

Keywords: Urban Infrastructure; Adaptation Strategies; Green Infrastructure; Sustainable Urban Planning

Demonstration on integrated management of potato late blight disease in Kolar district of Karnataka

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ABSTRACT

The potato is major vegetable crop of India known for food and nutritional security. The potato is predominantly rabi crop of Kolar and Chikkaballapura districts of Karnataka. Farmer get lower yield mainly due to diseases, pests and improper application of fertilizers. So, for the management of late blight disease, farmers were using indiscriminate of fungicides. Therefore ICAR-KVK Kolar, Karnataka, India demonstrated the technology provided by UHS Bagalkot and UAS Bengaluru for the management of the late blight of potato as soil application of bioagents *Trichoderma sp* and *Pseudomonas sp.* and application of mepiquat chloride and need based fungicides as Fenomidon+ Mancozeb and cymaxamil+Mancozeb. In the demonstration reduction in the late blight incidence 9.31% in demo and 29.35% in control. The average increases in plant fresh weight 183.05g and number of tubers per plant 11.50 whereas 1989.5 fresh weight and 9.10 tubers per found in farmers practice. The average increase in the potato tuber yield 25.22 t/ha over (20.73 t/ha) over the farmers practice. Farmers realized on integrated management practices yield high net returns (58320 Rs./ ha) and benefit cost ratio (1.30) as against farmers practice (17928 Rs/ha and 1.09 net returns and benefit cost ratio respectively).

Keywords: Potato, Kolar, Lateblight and front line demonstration

Socio-economic and Personal Characteristics of the Beneficiaries under PM-KISAN Samman Nidhi Scheme

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ABSTRACT

The PM-KISAN Samman Nidhi Scheme was introduced by the central government in December 2018 to assist farmers in purchasing various agricultural products. From February 2019, the eligible farmers were receiving assistance of rupees 6000 per year in three payment mode of 2000 rupees in each installment. 120 PM-KISAN recipients were selected from Kanpur Dehat district of Uttar Pradesh for the research. Primarily socio-economic and personal characteristic of each respondent was considered for the study. According to the study, the majority of respondents (61.66%) belonged to the older age group, were functionally illiterate (30.83%), belonged to other backward caste (45%), had small families (87.50%) and small land holdings (45.00%). They were also members of only one organization (38.33%) and had medium levels of annual income (65.83%) and farming experience (57.5%). The results also showed that most respondents have a moderate level of risk aversion, economic drive, scientific orientation, and innovativeness. Overall, scheme is successful in the study locale though respondents were suggested for annual revision of installments.

Keywords: Farmers, Personal Characteristics, PM-KISAN, Scheme, Socio-Economic.

Design and Fabrication of Battery-Powered Grass Cutter

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ABSTRACT

Grass cutting plays a crucial role in both agricultural and landscaping operations, traditionally carried out using machines powered by internal combustion engines. Although effective, these machines rely on non-renewable fossil fuels, contributing significantly to environmental degradation through increased air and noise pollution, and exacerbating global challenges like the greenhouse effect. To address these drawbacks, this project aims to design and develop an eco-friendly, battery-powered grass cutter that minimizes environmental impact while ensuring high performance and ease of use. The primary focus of this work is to reduce dependence on fossil fuels and simplify the grass-cutting process through a compact and efficient machine. The developed prototype is lightweight, easy to manoeuvre, and is especially suitable for small-scale agricultural fields, lawns, and garden areas. The grass cutter incorporates necessary parts such as direct current (DC) motors, a stainless-steel cutting blade, a 12V rechargeable battery, a speed controller, and wheels for mobility. It works on the fundamental principle of mowing. For longer life and better cutting performance, this project uses a stainless-steel blade. The speed controller aids in controlling the machine's movement according to field conditions. The battery-powered grass cutter was developed in two main phases: design and assembly. Components were chosen and sized during the design process, and all of the parts were combined into a functional prototype during the assembly phase. After finalization, field testing was done to evaluate performance in real-world conditions. The ergonomic analysis showed a noise level of 69.6 dB, handlebar vibration of 3.3 m/s², body vibration of 1.4 m/s², and a posture comfort rating of 4.5/5 with an average heart rate of 92.4 bpm; the operator showed minimal physical strain. Performance-wise, the machine's cutting efficiency was 88.2% and its field efficiency was 78.2%. Its effectiveness in small-scale applications was demonstrated by the field capacity, which was measured at 0.0525 ha/h with a cutting width of 30 cm and an operating speed of 1.5–2.0 km/h.

Keywords: Grass cutter, cutting efficiency, field efficiency, field capacity, and operating speed.

Role of AI and ML in Enhancing Drone Applications for Climate Research**Hemant Kumar Thakur¹, and Rahul Kumar²**^{1,2}*Department of Civil Engineering, Sandip University, Sijoul, Madhubani, Bihar, India***ABSTRACT**

Climate change is among the world's most urgent problems, and new solutions are needed to monitor, understand, and counteract its effects. Drones, or unmanned aerial vehicles (UAVs), are becoming a potent tool in climate science as they can gather high-resolution information from remote and inaccessible locations. The incorporation of artificial intelligence (AI) and machine learning (ML) in drone technology further augments their capabilities to facilitate autonomous flight, real-time analysis of data, and sophisticated pattern recognition. The paper is an extensive review of how AI and ML applications currently exist in drone-based climate studies. The review highlights major developments in such fields as drone autonomy, environmental surveillance, data analysis, and practical applications. It also lists challenges, including regulatory problems and computational limitations, and presents future research directions. This review highlights the revolutionary power of AI and ML in improving drone use for climate research and emphasizes their essential role in creating effective counterstrategies against climate change.

Keywords: Climate Research, Drone application, artificial intelligence, and machine learning

Protected Cultivation: A Boon for Indian Agriculture**Monisha T, MK Sidhu, Babanjeet and Anusha K R***Department of Vegetable Science, Punjab Agricultural University, Ludhiana***ABSTRACT**

Protected farming is a contemporary agricultural method that entails cultivating crops in a regulated environment, safeguarded against unfavourable weather conditions. This approach provides several benefits, such as enhanced production, superior quality, and prolonged growing seasons. Farmers can enhance plant growth and minimise water consumption by controlling temperature, humidity, and light conditions. India, with its varied environment and expanding population, offers substantial prospects for protected horticulture. Diverse buildings, including greenhouses, polyhouses, and net houses, are utilised to establish these regulated habitats. Nonetheless, obstacles such as substantial initial expenditures and the necessity for technical proficiency impede broad implementation. Notwithstanding these challenges, the prospective advantages of protected horticulture are considerable. It can assist India in attaining food security, enhancing rural lives, and diminishing its dependence on imports. Through investment in research and development, the promotion of sustainable practices, and the provision of comprehensive training to farmers, India can fully use the potential of protected agriculture and ensure a prosperous future for its agricultural industry.

Keywords: Polyhouses, greenhouse, quality, production, protection, and yield

Climate Resilient Agriculture**Pooja Goswami¹, Shraddha Karcho¹ and Vinod Bharati²**¹*Agronomy, Raja Bhoj College of Agriculture, Balaghat, JNKVV, Jabalpur.*²*Agronomy, G H Rasoni University, Chhindwara, M.P.***ABSTRACT**

Agriculture is central to India's food, nutritional, and livelihood security, engaging nearly two-thirds of the workforce and contributing significantly to GDP. However, the sector faces pressing challenges,

including stagnating net sown area, land degradation, declining per capita land availability, and increasing vulnerability to climate change. Small and marginal farmers, constituting about 80% of cultivators, are particularly at risk due to limited adaptive capacity. With nearly 60% of cultivated land being rainfed, climate variability—manifested through altered rainfall patterns, temperature rise, and extreme weather events—threatens productivity, stability, and rural livelihoods. India's agricultural sector is the primary source of livelihood for over 58% of its population and contributes around 17–18% to the national GDP (CSO, 2021). However, agricultural growth is increasingly constrained by shrinking land availability, declining soil quality, water scarcity, and the impacts of climate change. Climate-induced stresses such as droughts, floods, heatwaves, and unseasonal rains disproportionately affect the over 80% of Indian farmers who are small or marginal landholders.

Climate-resilient technologies (CRTs) offer an integrated approach to safeguarding farmer incomes, ensuring food security, and contributing to sustainable development goals. These include adaptive cropping systems, improved soil and water management, stress-tolerant crop varieties, efficient farm mechanization, rainwater harvesting, livestock and fisheries resilience measures, and institutional interventions such as custom hiring centers, seed banks, and weather-based agro-advisories. CRTs leverage agriculture's potential as a carbon sink through practices like residue incorporation, biochar application, green manuring, and diversification into climate-adapted crops.

This paper highlights physiological, technological, and institutional strategies for enhancing agricultural resilience, emphasizing planned adaptation, efficient resource use, and community participation. Strengthening soil health, conserving water, diversifying cropping systems, and integrating traditional knowledge with modern innovations are essential to mitigate climate risks. Given the projected yield declines and economic losses under future climate scenarios, widespread adoption of CRTs is no longer optional but a necessity for sustaining productivity, protecting livelihoods, and ensuring long-term ecological balance in Indian agriculture.

Keywords: Climate-resilient technologies, Physiological, technological, and conserving water

Farmers' Perception of & Adaptation to Climate Change in District Ramban of Jammu & Kashmir

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ABSTRACT

The nexus of climate change and agriculture is becoming more intense and having catastrophic impacts on food and nutritional security, especially in developing countries. Amongst the developing countries, India has been recognized as one of the most vulnerable developing countries towards climate change risks. This research paper highlights the impact of climate change on the environment as well as on agriculture and various adaptation measures taken by the farming community. As far as the impact of Climate change is concerned, the data from the research study reveals that 84% of the respondents believed that the pre-monsoon showers are now absent. Regarding the change in rainfall pattern, 82% farmers thought that the rainfall is untimely. Similarly, about the impact of climate change on agriculture, 62% of the farmers had observed the emergence of new insect-pests and diseases due to climate change over the last few years. Failure of seeds to germinate (especially maize) was also reported by 84% of the respondents. In the case of vegetables, 44% of respondents said that there is an increased vegetable seedling mortality rate due to increased temperatures. A decrease in yield was reported by 94% of the farmers. The various adaptation strategies include late sowing, resowing, conservation practices like mulching and drip/sprinkler irrigation, growing of vegetables and pulses, and a shift towards natural farming. Of the various adaptation strategies by farmers, resowing of Maize as an adaptation strategy due to poor germination was done by 38 per cent of the farmers. About 22

percent of the respondents reveal that they prefer to grow pulses like Lentil, Mash, and Rajmash because these crops do not require much water. As far as the adaptation of conservation practices is concerned, the data is not very satisfactory. Only 16% of the respondents harvest water through small farm ponds. Line sowing is also done by just 14% of the respondents. Only 04 No. Of respondents use drip irrigation, and Mulching is done by only 12% of the respondents.

Keywords: Irrigation, Climate Change, Germination, and Farmers' adaptation

Ensuring Residue-Free Food Through Organic Practices

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ABSTRACT

Organic farming is a sustainable agricultural method that emphasizes ecological balance, biodiversity, and soil health while eliminating the use of synthetic pesticides, fertilizers, and genetically modified organisms. Instead, it relies on natural inputs such as compost, green manure, biofertilizers, and integrated pest management techniques. It plays a critical role in the production of residue-free food, which is increasingly demanded by health-conscious consumers concerned about the harmful effects of chemical residues in conventionally grown crops. Organic farming not only meets this demand but also contributes to long-term soil health, water conservation, and reduced environmental pollution. These practices not only ensure safer food but also support long-term environmental sustainability by enhancing soil fertility, reducing pollution, and preserving beneficial organisms. Despite challenges such as lower initial yields, certification complexities, and limited market access in some regions, organic agriculture offers a sustainable and safe alternative to conventional farming. These abstract highlights the essential role of organic practices in ensuring the production of residue-free food while contributing to global food security and environmental sustainability. In conclusion, organic farming offers a viable and environmentally friendly pathway to produce residue-free food, ensuring both human health and ecological well-being. It is an essential component of a sustainable food system for the future.

Keywords: Organic food; conventional farming; human health.

The Entangled Fate of Species: A One Health Analysis of Human- Animal Well-being in the Indian Subcontinent

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ABSTRACT

This study provides a comprehensive analysis of the complex interdependencies governing human and animal health and well-being, using India as a critical case study. It introduces the "One Health" framework as the essential lens through which to examine these relationships, from the symbiotic foundations of livestock and companionship to the fracturing interface of zoonotic disease and human-wildlife conflict. The analysis reveals a series of critical paradoxes: a "livestock revolution" that simultaneously enhances food security and elevates zoonotic risk; an urban "wellness paradox" where companion animals improve mental health while introducing new disease vectors; and a "surveillance contradiction" where the communities most vulnerable to disease have the least access to public health infrastructure. By synthesizing data on socio-economics, public health, environmental science, and national policy, the paper argues that India's experience offers a vital

microcosm of the global challenges and opportunities in achieving sustainable health for all species. It concludes by offering evidence-based recommendations for bridging the gap between national One Health policy and local implementation, emphasizing the need to address systemic governance challenges and empower frontline communities.

Keywords: Livestock Revolution, Health Analysis and Species

From Farm to Fortress: Agroforestry as a Cornerstone of Natural Resource Management and Environmental Security in India

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ABSTRACT

This study posits that agroforestry as an agricultural diversification, is a critical, farm-level strategy for bolstering national environmental security. By synthesizing extensive data on natural resource degradation in India's Indo-Gangetic Plains, this research first establishes the anatomy of environmental insecurity, focusing on the cascading crises of groundwater depletion and soil degradation driven by conventional agricultural systems. It then presents a multi-faceted analysis of diverse agroforestry systems—including commercial Agri silviculture, Agri-horticulture, and silvopastoral models—as strategic natural resource management interventions. Drawing on detailed case studies from Uttar Pradesh and other Indian states, the paper quantifies the ecological and socio-economic benefits of these systems, such as improved water-use efficiency, enhanced soil health, significant carbon sequestration, and diversified rural livelihoods. However, the analysis reveals a profound implementation gap, primarily rooted in the political economy of forest governance. A critical examination of the National Agroforestry Policy (2014) and a comparative analysis of state-level timber transit regulations expose a fundamental paradox where restrictive, state-led forestry rules undermine national agricultural policy, creating a significant disincentive for farmer adoption. The study concludes by proposing an integrated "Agro-Ecological Security Framework" and offers multi-layered policy recommendations aimed at resolving this governance conflict, strengthening market linkages through Farmer-Producer Organizations (FPOs), and aligning financial mechanisms to scale agroforestry from a niche practice to a foundational pillar of India's environmental security strategy.

Keywords: Agricultural diversification, FPO and Natural Resource Management

Evaluation of Medicinal Properties of the plant *Bauhinia variegata*.

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ABSTRACT

Bauhinia variegata, commonly known as Kachnar is a medium-sized tree which belongs to the Fabaceae (legume) family and subfamily Caesalpiniaceae is found in many parts of India and Southeast Asia. The tree is well known for its attractive, orchid-like flowers that appear in shades of pink, purple, or white, usually blooming during late winter to early spring. Its leaves are unique, shaped like a camel's hoof, with two rounded lobes. *Bauhinia variegata* is a well-known medicinal plant used widely in traditional Indian medicine for the treatment of various health disorders. Traditionally, it has been used to treat ulcers, infections, skin diseases, inflammation, and respiratory conditions. Carbohydrates, tannins, alkaloids, flavonoids are the important constituents of Kachnar. This study explores the medicinal properties of *Bauhinia variegata* by preparing plant extracts using two conventional methods, decoction and maceration and evaluating their biological activity.

In the decoction method, plant parts were boiled in water to extract water-soluble and heat-stable compounds. In contrast, the maceration method involved soaking the plant material in a solvent at room temperature, ideal for preserving heat-sensitive bioactive compounds. The macerated extract showed strong antioxidant potential due to the retention of delicate compounds that are often lost during heat-based extraction. This study shows both decoction and maceration extract have therapeutic compounds contributing uniquely to its medicinal profile. The findings affirm the traditional relevance of *Bauhinia variegata* and suggest its promising role in developing natural, plant-based remedies for modern healthcare.

Keywords: *Bauhinia*, Decoction, Maceration, Phytochemicals

Crop production in natural farming for efficient natural resource management

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ABSTRACT

The natural farming (NF) is climate resilient, environmental responsive, complex production system with crops, trees and animal as components. Being differentiated from well-established organic farming and varied opinions of different workers across India, there is growing interest and need for formulating production practices for NF. The development of production practices is also important for standards establishment, certification and marketing/ product policy development. Hence identifying the potential of different practices, inputs, strategies, methodologies and procedures is needed to develop production practices. This process is initiated with gathering of Indigenous technical knowledge (ITKs) related with crop cultivation followed by their enrichment with desired technologies. The next step is investigating the perennial tree species and their suitability in natural farming and practices for their management. Integrating animal component in production system followed by its role in crop/ tree cultivation and soil health management is executed in third step. Implementing NF in small area, learning about bio-inputs production in-situ and gaining awareness about NF through training/ workshop helps initiate NF. Among the tree components involved in NF, it will be easy to initiate with crops. This is due to short life cycle, more information availability about cultivation practices and easy to develop and follow cultivation practices. It will be worthy to develop soil, plant and water management practice matching to the principles of NF before developing individual crop management practices. The soil health, crop diversification and rotation and in-situ and ex-situ water harvesting is important in NF. In conclusion, step by step approach starting with crops followed by (fb) tree fb animal, soil fb plant fb water, learning fb practices, fb post-harvest production, input production fb, health care system fb developing market infrastructure will make it easy to adopt and make NF a successful production system.

Keywords: Crops, Bio-Inputs, Soil Health, Water Harvesting

Digital Entrepreneurship for Inclusive Growth

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ABSTRACT

The global shift towards a tech-driven society has necessitated the transformation of traditional entrepreneurial ecosystems. In emerging economies, entrepreneurship is not only a catalyst for economic development but also a critical pathway for achieving social inclusion and environmental sustainability. However, challenges such as digital divide, limited access to capital, and lack of

entrepreneurial education hinder inclusive participation in innovation-driven growth. This study explores the role of digital transformation in fostering inclusive and sustainable entrepreneurship in developing regions, with a focus on low-cost technological innovations, green entrepreneurship, and community-based business models. Using a mixed-methods approach, this research combines qualitative case studies of digital entrepreneurship initiatives in South Asia and Sub-Saharan Africa with quantitative data analysis from World Bank and Global Entrepreneurship Monitor (GEM) datasets. Parameters assessed include digital accessibility, entrepreneurial finance access, growth performance, and social capital indices. Preliminary findings indicate that digitally enabled entrepreneurial models—such as mobile-based agri-startups, digital learning platforms for skill development, and fintech-based microenterprises—have significantly increased youth and women’s participation in entrepreneurship. Moreover, ventures grounded in sustainable practices and local innovation demonstrate higher resilience during economic disruptions. Digital transformation serves as a key enabler for building inclusive, knowledge-based, and environmentally responsible entrepreneurship ecosystems. Policymakers and academic institutions must prioritize digital infrastructure, entrepreneurial education, and public-private partnerships to bridge opportunity gaps and foster sustainable development. The study underscores the need for a systemic shift from conventional business paradigms to human-centric, digitally empowered, and socially inclusive innovation frameworks.

Keywords: Entrepreneurship, global, tech-driven, sustainability, challenges, quantitative data, parameters, human-centric

Building Resilient Economies with Green Entrepreneurship

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ABSTRACT

Green and sustainable entrepreneurship focuses on creating business ventures that balance economic growth with environmental protection and social responsibility. This approach integrates innovative business models, renewable resources and eco-friendly technologies to minimize ecological footprints while delivering long-term value. By emphasizing circular economy principles, waste reduction and sustainable supply chains, green entrepreneurs contribute to climate change mitigation and biodiversity conservation. Furthermore, sustainable entrepreneurship promotes inclusive growth by generating green jobs and fostering community engagement. It aligns with global sustainability goals, such as the United Nations Sustainable Development Goals (SDGs), by addressing pressing environmental challenges through responsible business practices. The transition toward green and sustainable entrepreneurship is essential for building resilient economies, ensuring resource efficiency, and securing a healthier planet for future generations.

Keywords: Green entrepreneurship; Sustainable development; Circular economy; Eco-innovation; Climate change mitigation

The Role of Government Policy in Fostering Sustainable Agriculture**Sharath M N^{1*}, Abhishek Sanglekar², Santosh Mavinalli³, Satish D² and Deepak S Kore³**¹*Department of Vegetable Science*²*Department of Genetics and Plant Breeding*³*Department of Fruit Science, University of Horticultural Sciences, Bagalkot, Karnataka, India***ABSTRACT**

Sustainable agriculture is increasingly recognized as essential for addressing the interconnected challenges of global food security, environmental degradation, and climate change. The transition from conventional, input-intensive farming to sustainable systems is often hindered by economic, social and technical barriers that exceed the capacity of individual farmers to overcome. Targeted and well-designed government interventions are therefore critical. Global policy instruments promoting sustainable agriculture can be classified into financial incentives and disincentives (e.g., subsidies, payments for ecosystem services), regulatory frameworks (e.g., environmental standards, land-use zoning), support for research and extension, investments in infrastructure and market development, and comprehensive national missions. While these policies have fostered the adoption of practices such as organic farming and conservation tillage, their broader impact is constrained by conflicting objectives, inadequate funding, weak implementation, limited farmer awareness and poor inter-agency coordination. Achieving a truly sustainable agricultural sector requires greater policy coherence that integrates agricultural, environmental, and trade agendas, supported by evidence-based evaluation, local institutional empowerment, just transitions for smallholders and adaptive, long-term strategies to enhance food system resilience.

Keywords: Sustainable agriculture; Policy instruments; Government intervention; Climate change; Food systems resilience

Eco-friendly management for Mycotoxin in Field and Horticultural Crops and Stored Products**Shravan Kumar, Surush Das, Shradha Subba and Sonam Jha***RGSC, Banaras Hindu University, Barkachha, (Mirzapur)-231307, India***ABSTRACT**

Crops most vulnerable to mycotoxins include maize, millet, wheat, sorghum, soybean, and peanut, along with their derivatives and by-products. Mycotoxins are also found in moldy food waste, bread, cottonseed, cereals, leguminous seeds, and oilseeds. These toxins can impact human exocrine and endocrine systems, suppress immunity, and cause teratogenicity, carcinogenicity, and mutagenicity. Common mycotoxins include Aflatoxins (AFs: B1, B2, G1, G2, M1), Ochratoxins (mainly Ochratoxin A), Fumonisin (FB1, FB2, FB3), Trichothecenes (type A: HT-2, T-2; type B: DON), Zearalenone (ZEN), Fusarium mycotoxins like fusaproliferin, moniliformin, beauvericin, NX-2, Enniatins, Ergot alkaloids, Alternaria toxins (e.g., Alternaria, AOH, AME, Altertoxin, Tenuazonic acid), and Patulin (PAT). These toxins originate from fungi like *Penicillium*, *Fusarium*, *Aspergillus*, and *Alternaria*. Aflatoxins and ochratoxins are mainly produced by *Aspergillus* spp., Fusarium toxins by *Fusarium* spp. (e.g., ZEN, DON, T-2, FBs), and PAT by *Penicillium expansum*. Fungal growth occurs optimally at 10–40°C, pH 8.4, and water activity above 0.70, with field fungi favoring 70–90% relative humidity and temperatures of 20–25°C. Detection methods such as HPLC, HPLC-MS/MS, rapid detection, and field monitoring are vital but face limitations like high costs, sensitivity variability, false positives, and limited field use. Prevention and control strategies include selecting resistant crop varieties, standardized drying, sterilization, appropriate packaging, enhanced risk monitoring, and detoxification using thermal, radiation, or plasma methods, as well as chemical (oxidation, reduction, hydrolysis, alcoholysis, absorption) and biological (biological agents) approaches.

Keywords: Maize, peanut, mycotoxins, Risk Monitoring Programs carcinogenicity and cold plasma

Changes in soil properties under fruit tree species in semi-arid zone

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ABSTRACT

The present study, entitled "Changes in soil properties under fruit tree species in semi-arid zone" was carried out in 2022-2023 at the experimental farm of the Department of Horticulture, CCSHAU, Hisar, to study the effect of fruit tree species on physical, chemical and biological properties of soil. Soil samples were collected from four fruit tree species and bare site (control) at four depths (0-15, 15-30, 30-60, 60-90 cm) to analyze different soil properties. Experiment was laid out in RBD design with four replications. Four fruit tree species namely *Mangifera indica*, *Psidium guajava*, *Syzygium cumini* and *Aegle marmelos*, were selected for the study. The results of the present investigation showed that nutrient levels were higher at the surface layer (0-15 cm) of soil and decreased with increasing depth. Soil pH and EC reduced significantly under jamun and guava orchards by 5.8 % and 81.9 %, respectively over control. Highest pH and EC was recorded in mango orchard. Jamun orchard recorded highest OC, N, total N, S and DTPA extractable Fe, Mn, Zn while as available P, K, total P, K, DTPA extractable Cu were found to be highest in bael orchard. Soils under bael orchard recorded the highest total Fe, Mn and Cu content while as total Zn was found to be highest in soils under guava orchard. MBC and dehydrogenase activity increased by 43.8 % and 71.8 % in jamun, 41.4 % and 59.3 % in bael, 39.6% and 54.6 % in guava and 33.5% and 53.1 % in mango over control. Highest percent increase in alkaline phosphatase and urease activity was by jamun (45.8 % and 40.3 %), followed by bael (38.3 % and 39 %) and lowest in control. Highest bulk density and penetration resistance was observed in mango orchard and lowest in jamun orchard. Highest water holding capacity was recorded in jamun (40.6 %), followed by bael (38.8 %), guava (38.5 %) and mango (36.3 %).

Keywords: Fruit tree species, Semi-arid zone, Soil depth, Soil properties

Impact of Sprinkler Irrigation Technology on Groundnut Production and Water Use Efficiency in Drought-Prone Regions of Yadgir District, Karnataka"

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ABSTRACT

Water is a vital resource for agricultural productivity, particularly in water-scarce regions such as Karnataka, India, where droughts and erratic rainfall patterns often threaten food security and economic stability. This study aims to evaluate the impact of Sprinkler Irrigation Technology (SIT) on groundnut cultivation in Yadgir District, Karnataka, with a focus on its effect on production, economics, and water-use efficiency. The research was conducted using an 'ex-post facto' research design, and data was collected from farmers in three talukas—Yadgir, Shahapur, and Shorapur—who adopted SIT under the Pradhan Mantri Krishi Sinchayee Yojana (PMKSY). The results indicated that the adoption of SIT led to a 24.40% increase in groundnut yield, from 2110 kg/ha under flood irrigation to 2625 kg/ha under SIT. The total cost of cultivation was higher for SIT (Rs. 49,000/ha) compared to flood irrigation (Rs. 45,000/ha), primarily due to the initial setup and maintenance costs of the sprinkler system. However, gross returns increased by 24.40%, and net returns saw a significant rise of 31.21%, with a B:C ratio of 3.75 for SIT compared to 3.28 for flood irrigation. Additionally, the study found that SIT improved

water use efficiency (WUE), reducing water consumption by 18.75% while increasing WUE by 53.50%. These findings suggest that SIT not only enhances crop productivity but also optimizes water use, crucial in the context of water scarcity. This study demonstrates the effectiveness of SIT in improving groundnut production and highlights its role in promoting water conservation and agricultural sustainability in drought-prone regions.

Keywords: Drought, Flood irrigation, Sprinkler irrigation technology, Water productivity, Groundnut crop and Water-use efficiency

Chawki Rearing as a Resilient Intervention in Indian Sericulture: An Outlook on the Present Status

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ABSTRACT

Climate change and global warming have profoundly impacted natural farming systems across the globe, and India's sericulture-based agricultural systems are no exception to this phenomenon. The sericulture sector, which is highly sensitive to climatic variables, faces disruptions due to a combination of interrelated factors. These include erratic temperature fluctuations, unpredictable changes in precipitation patterns, High incidences of pest and disease outbreaks and increased frequency of extreme weather events. Such conditions adversely affect mulberry cultivation, silkworm growth and cocoon productivity, thereby posing a serious threat to the socio-economic viability of sericulture-based farming practices as a livelihood. Particularly, the vulnerability of early-stage silkworms to climatic stress, disease and nutritional imbalances has intensified under changing environmental conditions, leading to reduced cocoon yields and diminished farm incomes. In this context, chawki rearing has emerged as a prominent technology to sustain sericulture practices in India. This scientific approach focuses on the effective management of young silkworms during their first two instars by offering a controlled environment against erratic temperatures and humidity fluctuations. This paper provides a comprehensive overview of the current status of chawki rearing practices and the functioning of rearing centres across multiple states in India. For this purpose, a wide range of scientific literature and technical reports from both state and non-state actors were thoroughly reviewed. The review indicates that chawki rearing in India has shifted from farm-level to organized Chawki Rearing Centres (CRCs) across all major sericulture states, supported by both government and private initiatives. These centres, equipped with controlled environments and disease management protocols to supply healthy and uniform young silkworms, improving survival rates and raising cocoon yields by 10–25% over traditional methods. While southern states like Karnataka and Tamil Nadu show high adoption and productivity while eastern, northeastern and temperate regions are steadily scaling up CRC operations with policy and infrastructure support.

Keywords: Chawki Rearing, Chawki Rearing Centre, Sericulture, Climate change and Silkworm

Influence Of Various Plant Spacing's and Nutrient Levels, Yield and Nutrient Dynamics of Brown Top Millet (*Brachiaria Ramosa* L.) Under Rainfed Areas of Northern Karnataka**Ashoka P, Mahantesh B Nagangoudar and Rajakumar G R**¹Department of Agronomy, College of Agriculture, Hanumanamatti (University of Agriculture science, Dharwad), Karnataka, India- 581115²DST-EESES Project, AICRP on Castor, ZARS, UAS, GKVK, Bengaluru-560065³Dept of Soil science, UAS, Dharwad-580005, Karnataka,**Purpose**

Brown top millet (*Brachiaria ramosa* L.) is a rare, annual, warm-season grass from the Poaceae family, mainly used in forage systems. Native to Southeast Asia, it is grown in regions like Western Asia, Africa, and Australia. In India, it thrives in dryland areas, particularly along the Karnataka-Andhra Pradesh border. Brown top millet with its peculiar physio-biological characters serves as a climate-resilient crop and grows well in various soils. Its rapid growth makes it ideal as a catch crop to control soil erosion. Nutritionally, it surpasses other millets, offering high fiber, protein, calcium, and iron, making it beneficial for diabetes and malnutrition. Hence, the browntop millet's appeal extends to both farmers and consumers, making it a promising crop for addressing climate change, malnutrition, and lifestyle diseases, while also offering potential for agricultural entrepreneurship. Though, farmers are cultivating the crop since ages the yield levels are very low as against its production potentiality. Lack of standardized package of practice is the major constraint in widening the gap between production potential yield and actual yield at farmer's field. To address this gap, the present study was conducted with following objective,

To study the effect of varied drilling patterns and nutrient levels on yield levels of brown top millet to provide farmers with standard drilling patterns and nutrient levels for higher yield of brown top millet.

Material and Methods

The field experiment was conducted during *Kharif* season for three consecutive years from 2021 to 2024 at ICAR-Krishi Vignan Kendra, Hanumanamatti, Haveri, Karnataka. This zone falls under Northern Transitional Zone (Agroclimatic Zone VIII) of Karnataka. The soils are slightly acidic possessing red sandy loam texture. The experiment was laid out in Split Plot Design and replicated thrice. The main plot consisted of three varied drilling patterns (S₁: 30 cm X 10 cm, S₂: 45 cm X 10 cm and S₃: 60 cm x 10 cm) and the sub-plots consisted of three levels of nutrients (N₁: 30:15:15 kg NPK ha⁻¹, N₂: 45:22.5:22.5 kg NPK ha⁻¹ and N₃: 22.5:10:10 kg NPK ha⁻¹). The seeds were sown in the beds of 3.6 m x 3.0 m dimension surrounded by raised bunds during first fortnight of July every year. The FYM @ 6 t ha⁻¹ was commonly applied to all the treatments two weeks prior to sowing and 100% P&K and 50% N were applied as basal dose followed by two top dressing of N at 30 and 60 DAS. At harvest, the yield parameters and yield of browntop millet was recorded from the net plots of the three replications and expressed as means of each treatment. Further, the data of three consecutive seasons was pooled and presented as below in the Figure

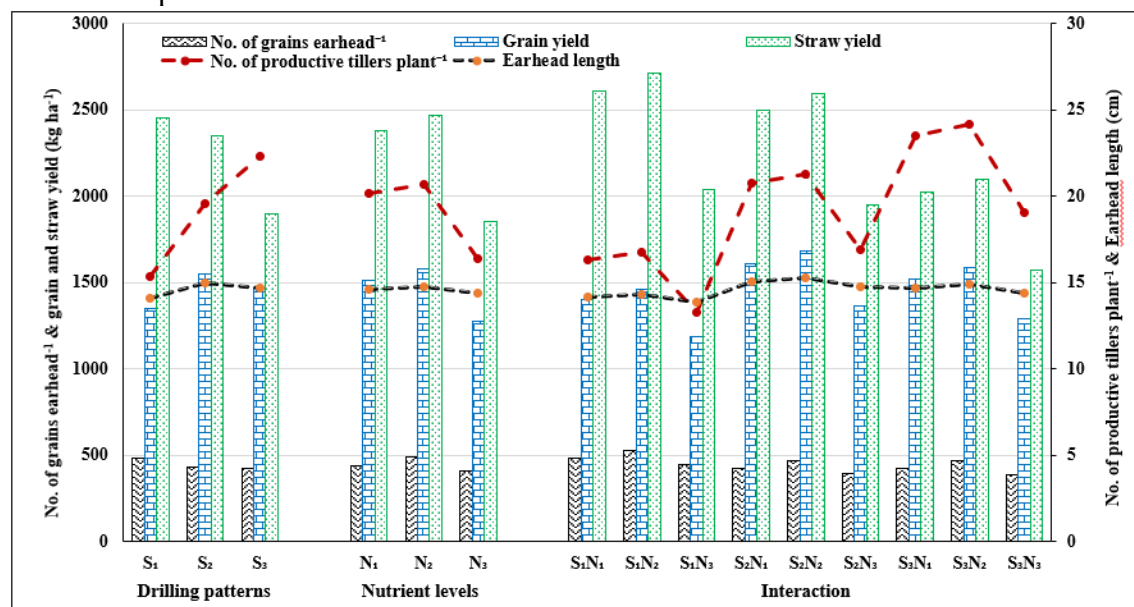
Results

The results pertaining to effect of varied drilling patterns and nutrient levels on yield attributes and yield of browntop millet is depicted in Figure 1. Among the varied drilling patterns, drilling browntop millet seeds at a spacing of 45 cm x 15 cm resulted in significantly higher earhead length (15.1 cm) and grain yield (1555 kg ha⁻¹), while, number of grains per panicle (487) and straw yield were significantly higher under 30 cm x 10 cm spaced treatment. However, number of productive tillers per plant were significantly profuse under wider spaced treatment i.e., 60 cm x 10 cm (22.3). The varied levels of nutrients supply had significant influence on yield attributes and yield of browntop millet. The application of 45:22.5:22.5 kg NPK ha⁻¹ resulted in significantly higher number of productive tillers per plant (20.7), earhead length (14.8), number of grains per earhead (491), grain yield (1580 kg ha⁻¹) and

straw yield (2470 kg ha^{-1}). The crop performance with respect to yield attributes and yield showed a gradual decrease with reduced levels of nutrient levels application. The lowest values of yield attributes and yield were recorded under least supply of nutrients i.e., ($22.5:10:10 \text{ kg NPK ha}^{-1}$). The varied levels of nutrient and drilling patterns showed significant interaction effects on yield attributes and yield of browntop millet. The treatment combination of wider spacing and highest nutrient level supply ($60 \text{ cm} \times 15 \text{ cm}$ spacing supplied with $45:22.5:22.5 \text{ kg NPK ha}^{-1}$) resulted in significantly higher grain yield (1591 kg ha^{-1}) over rest of the treatment combinations.

Conclusion

The spacing of $45 \text{ cm} \times 10 \text{ cm}$ and application of $45:22.5:22.5 \text{ kg NPK ha}^{-1}$ were found to be the optimum crop management practices in order to achieve higher grain yield levels. Hence, these can be recommended for rainfed areas of Northern Transitional Zone of Karnataka as standard agro-techniques for browntop millet cultivation.



Legend:

Drilling patterns; S₁: $30 \text{ cm} \times 10 \text{ cm}$, S₂: $45 \text{ cm} \times 10 \text{ cm}$ and S₃: $60 \text{ cm} \times 10 \text{ cm}$

Nutrient levels; N₁: $30:15:15 \text{ kg NPK ha}^{-1}$, N₂: $45:22.5:22.5 \text{ kg NPK ha}^{-1}$ and N₃: $22.5:10:10 \text{ kg NPK ha}^{-1}$

Figure 1: Effect of varied drilling patterns and nutrient levels on yield attributes and yield of browntop millet (pooled of 3 years)

Keywords: Brown top millet, Spacing, Nutrient level, Yield

Nanobubble Irrigation: A Synergistic Approach to Crop Yield, Water Efficiency, and Soil Health Meghna Sarkar^{1*} and K.N. Das¹

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ABSTRACT

The escalating global population, compounded by the persistent challenges posed by climate change and the depletion of natural resources, has intensified the need to revolutionize agricultural practices toward greater sustainability. In response to mounting concerns over food security and sustainability, as well as the imperative to enhance crop productivity, nanobubbles (NBs) have emerged as a promising innovation in agricultural research, offering potential benefits for sustainable crop production. Nanobubbles are defined as ultrafine bubbles with diameters typically between 50 and 200 nm, and less

than 1000 nm overall. They exhibit longer lifespans in aqueous environments, promoting gas dissolution and oxidation through the formation of hydroxyl radicals upon collapse. In fruiting vegetables like tomato and cucumber, NB-based irrigation significantly enhanced yield, irrigation water use efficiency, and fruit quality parameters such as vitamin C and soluble sugar content. In optimal treatment scenarios, tomato yields increased by 16.9%, with notable improvements in water use. Cucumber crops showed even greater yield improvements (22.1%), along with gains in water efficiency (22.1%) and fruit quality. The rice field experiment showed significant increase in rice yield with NB treatment, potentially saving 25% of the fertilizer. The application has increased the total C, organic matter, available nitrogen, and available potassium in soil. Cross-sectional and longitudinal soil profiles reveal that nanobubble-treated soils exhibit finer pore structures compared to control treatments. X-ray microtomography results confirmed a 355.1% increase in pore connectivity and a 43.1% increase in total porosity. Crucially, nanobubble technology shows potential for enhanced nutrient utilization, higher microbial diversity, combined with soil remediation strategies that allow plants to achieve comparable yields with significantly less fertilizer dependency, offering environmental and economic benefits for sustainable agriculture.

Keywords: Nanobubble, Water use efficiency, Crop yield, Soil health, Climate change

Hi-Tech Horticulture for the Future: Integrating Innovation with Sustainability

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ABSTRACT

Hi-tech horticulture represents a shift from traditional practices to technology-intensive, capital-driven systems aimed at meeting rising food demand, improving crop quality, and ensuring sustainability amid climate change, shrinking arable land, and resource scarcity (Wheeler & von Braun, 2013). It integrates protected cultivation, soil-less farming, precision resource management, automation, biotechnology, and digital tools such as the Internet of Things (IoT), Artificial Intelligence (AI), and blockchain. These innovations enhance yields, improve produce quality, and optimize inputs like water and fertilizers. Challenges include high initial investment, the need for skilled labor, and environmental concerns such as energy use and waste management. The future scope lies in urban farming, climate-resilient agriculture, and global food security. Successful adoption will require integrated strategies, continuous innovation, and supportive policies to ensure accessibility and sustainability across farming scales.

Keywords: Hi-tech horticulture, protected cultivation, soil-less farming, precision agriculture, automation, biotechnology

Farmer Income Enhancement Strategies**Santosh Mavinalli¹, Dr. S. N. Patil², Abhishek³, Iranna Biradar⁴ and Virupakashi Khanapuri⁵**^{1,2}*Department of Fruit Science, College of Horticulture Bagalkot, University of Horticultural Sciences, Bagalkot*³*Department of Genetics and Plant breeding, College of Horticulture Bagalkot, University of Horticultural Sciences, Bagalkot*⁴*Department of Food Science and Nutrition, College of Community Science, University of Agricultural Sciences, Dharwad.*⁵*Department of Horticulture, College of Agriculture, Dharwad, University of Agricultural Sciences, Dharwad***ABSTRACT**

Enhancing farmer income is central to alleviating rural poverty, ensuring food security, and promoting sustainable agricultural development. Strategies for small and marginal farmers include productivity and efficiency improvements, agricultural diversification, enhanced market access, sustainable practices, digital technology integration, and supportive policies. Technological interventions, diversification into high-value crops and livestock, and strengthening Farmer Producer Companies (FPCs) are key drivers of income growth. Success depends on supportive policies, robust rural infrastructure, and effective risk management (Hazell et al., 2010). Research gaps are identified, and future directions are outlined for building a resilient and profitable agricultural sector.

Keywords: Farmer income, agricultural diversification, productivity improvement, sustainable practices, digital agriculture

Indigenous Technical Knowledge (ITK) in Pomegranate Production**Iranna Biradar^{*1}, Santosh Mavinalli², Dr. S. N. Patil³, Abhishek⁴ and Virupakashi Khanapuri⁵**^{1,2}*Department of Food Science and Nutrition, College of Community Science, University of Agricultural Sciences, Dharwad*³*Department of Fruit Science, College of Horticulture Bagalkot, University of Horticultural Sciences, Bagalkot*⁴*Department of Genetics and Plant breeding, College of Horticulture Bagalkot, University of Horticultural Sciences, Bagalkot*⁵*Department of Horticulture, College of Agriculture, Dharwad, University of Agricultural Sciences, Dharwad***ABSTRACT**

Indigenous Technical Knowledge (ITK) is a valuable, experience-based knowledge system developed by farmers over generations. In the context of pomegranate (*Punica granatum* L.) cultivation, especially in the dryland regions of Maharashtra and Karnataka, numerous ITKs have evolved addressing soil fertility, pest and disease management, flowering regulation, and fruit quality. This paper documents and evaluates farmer-driven ITKs such as sour buttermilk application for bacterial blight, cow dung and ash mixture for stem borer control and sheep penning for flower induction (NRC Pomegranate, 2018). These practices were documented through Participatory Rural Appraisal (PRA) and validated on-farm. Findings support their integration into modern horticulture to enhance sustainability, reduce input costs, and preserve traditional knowledge.

Keywords: Pest management, disease control, flowering induction, farmer innovation, pomegranate, buttermilk

The Role of Grape Raisins (*Vitis vinifera*) in a Health-Promoting Diet**Iranna Biradar^{*1}, Santosh Mavinalli², S. N. Patil³, Abhishek⁴ and Virupakashi Khanapuri⁵**^{1,2}*Department of Food Science and Nutrition, College of Community Science, University of Agricultural Sciences, Dharwad*³*Department of Fruit Science, College of Horticulture Bagalkot, University of Horticultural Sciences, Bagalkot*⁴*Department of Genetics and Plant breeding, College of Horticulture Bagalkot, University of Horticultural Sciences, Bagalkot*⁵*Department of Horticulture, College of Agriculture, Dharwad, University of Agricultural Sciences, Dharwad***ABSTRACT**

Raisins (*Vitis vinifera*) are nutrient-dense dried fruits rich in natural sugars, dietary fiber, essential minerals, and bioactive polyphenols. Scientific evidence from observational studies, clinical trials, and experimental models links regular raisin consumption to improved cardiovascular health, better gastrointestinal function via prebiotic effects, and potential benefits for oral health, bone density, and glycemic control. These effects are largely attributed to their antioxidant, anti-inflammatory, and fiber content. Research gaps remain regarding long-term outcomes, optimal intake, and translation from animal to human studies.

Keywords: Raisins, *Vitis Vinifera*, Dietary Fiber, Polyphenols, Cardiovascular Health

Innovations in English Language Learning and Teaching**Surinder Sangwan***Department of English, Pt NRS Govt College, Rohtak, Maharishi Dayanand University***ABSTRACT**

The rapid technological breakthroughs and the changing demands of global communication have completely changed the way that English is taught and learned. In order to improve language acquisition, this study examines new developments that combine learner-centred methodologies, pedagogical techniques, and digital resources. Artificial intelligence-driven learning platforms, augmented and virtual reality settings, gamified apps, and adaptive learning systems that tailor education are important areas of innovation. The usefulness of pedagogical innovations including task-based language instruction, the flipped classroom model, and content and language integrated learning (CLIL) in encouraging student participation and real-world communication skills is investigated.

The study also highlights the role of collaborative global learning networks and innovative assessment methods in promoting intercultural competence and autonomous learning. Benefits such as increased learner motivation, flexibility, and real-world contextualization are weighed against challenges including the digital divide, teacher preparedness, and potential over-reliance on technology. The findings suggest that sustainable adoption of these innovations requires balanced integration of technology with sound pedagogy, comprehensive teacher training, and equitable access to resources. This research contributes to the growing discourse on modernizing English language education to meet the linguistic and cultural needs of 21st-century learners.

Keywords: English language learning, teaching innovations, technology-enhanced learning, pedagogy, adaptive learning, gamification

Balancing the Carbon Cycle for Climate Change Mitigation**Deepashri J, Abhishek, Fakrudin B, Satish D, Lakshmiddevamma T N and Ragavendra Gunnaiah***Department of Biotechnology and Crop Improvement, University of Horticultural Sciences, Bagalkot, Karnataka, India 587 104***ABSTRACT**

The carbon cycle is a fundamental biogeochemical process that regulates the movement of carbon among the atmosphere, hydrosphere, lithosphere, and biosphere, thereby influencing Earth's climate system. Anthropogenic activities such as fossil fuel combustion, deforestation, intensive agriculture and industrial processes have significantly altered the natural carbon balance, leading to increased greenhouse gas (GHG) emissions, particularly carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O). These gases enhance the greenhouse effect, trapping infrared radiation and contributing to global warming and climate change. Disruptions in the carbon cycle not only accelerate atmospheric GHG concentrations but also impact carbon sinks such as forests, soils and oceans, reducing their capacity to sequester carbon. Understanding the dynamics of carbon fluxes, feedback mechanisms and emission sources is crucial for developing mitigation strategies, including renewable energy adoption, afforestation, carbon capture and storage and sustainable land-use practices. Strengthening global cooperation and policy frameworks is essential to balance the carbon cycle and reduce greenhouse gas emissions for climate resilience.

Keywords: Carbon cycle; greenhouse gases; CO₂ emissions; climate change; carbon sequestration; global warming.

Natural Products as Modulators of Plant Growth and Hormonal Balance**Deepashri J, Abhishek, Fakrudin B, Satish D, Lakshmiddevamma T N and Ragavendra Gunnaiah***Department of Biotechnology and Crop Improvement, University of Horticultural Sciences, Bagalkot, Karnataka, India 587 104***ABSTRACT**

Phytohormones play a pivotal role in regulating plant growth, development and responses to environmental stimuli. Natural products derived from plants, microbes and other biological sources have emerged as potent modulators of phytohormone biosynthesis, signalling, and homeostasis. Compounds such as flavonoids, alkaloids, terpenoids, phenolics and microbial metabolites can influence key hormonal pathways, including auxin, cytokinin, gibberellin, abscisic acid, salicylic acid, jasmonic acid and ethylene signalling. These bioactive molecules may act as precursors, inhibitors, or enhancers of hormone activity, thereby affecting processes like seed germination, root and shoot development, stress tolerance and pathogen defence. Understanding the mechanistic basis of phytohormone regulation by natural products provides opportunities for sustainable agriculture, crop improvement and bio stimulant development. Integrating natural product chemistry with molecular plant physiology offers a promising approach to enhancing plant productivity and resilience under changing environmental conditions.

Key words: Phytohormones; natural products; plant growth regulation; bio stimulants, secondary metabolites; stress tolerance

Revitalizing Mountain Landscapes through Traditional Agroforestry in Kashmir**Aafaq A. Parrey¹, G. M. Bhat¹ and N. A. Pala¹***¹Division of Silviculture and Agroforestry, Faculty of Forestry, SKUAST-Kashmir, Jammu & Kashmir, India***ABSTRACT**

The present study was conducted in two representative districts namely Baramulla and Anantnag of Kashmir, involving 120 farm households, revealed an average agroforestry plot size of 0.5–1.2 ha, with tree densities ranging from 120–180 trees/ha. Dominant species such as *Populus deltoides* (45%), *Salix alba* (30%), *Juglans regia* (15%), and *Aesculus indica* (10%) contribute up to 35% of household fodder demand and 25% of fuelwood consumption, significantly reducing extraction pressure on natural forests.

Diversity indices (Shannon-Weiner index: 1.8–2.5) indicate moderate species richness and structural diversity, supporting habitat connectivity for local flora and fauna. However, the study notes a 20–30% decline in agroforestry tree cover over the last two decades due to land fragmentation, unsustainable urban expansion, and weakening of traditional knowledge systems. Projected climate scenarios, including increased variability in snowfall and rainfall patterns, further threaten the sustainability of these systems. To address these challenges, the study recommends a three-pronged policy framework; (1) integrating traditional agroforestry into regional climate adaptation and land-use plans; (2) strengthening community-based institutions and farmer producer groups to enhance capacity building and market access; and (3) incentivizing agroforestry through payment for ecosystem services (PES) schemes and carbon credits. Modelling estimates suggest that scaling up resilient agroforestry could sequester an additional 1.5–2.2 tC/ha/year, contributing to India's Nationally Determined Contributions (NDCs) under the Paris Agreement. Recognizing, conserving, and revitalizing Kashmir's traditional Agroforestry systems can therefore play a transformative role in achieving ecological sustainability, economic resilience, and climate goals in fragile mountain regions.

Keywords: Traditional agroforestry, biodiversity conservation, climate adaptation, policy framework

Youth Voices for a Greener Future: Advocacy Through Education**Chaitali Karmakar***Extension education, Institute of Agricultural Sciences, Banaras Hindu University***ABSTRACT**

With over 1.2 billion people aged 15 to 24 worldwide, making up 16% of the global population, youth are in a strong position to influence climate action at local, national, and global levels. However, UNESCO's 2021 survey found that 70% of young people do not have enough knowledge about climate change. Only 33% feel empowered to take action related to climate issues (Anderson, 2024). This knowledge gap highlights the urgent need for focused climate education and advocacy skill-building. This study looks at how youth involvement in structured climate education programs leads to measurable advocacy outcomes. It uses examples from initiatives like UNICEF's Youth4Climate platform and the UNDP's Climate Promise. These initiatives have brought together millions of young advocates in over 100 countries. Data from the Fridays for Future movement shows the potential of youth-led advocacy, with more than 14 million participants in 7,500 cities worldwide since 2018, influencing policy discussions and public awareness.

Key strategies for engaging youth effectively include adding climate literacy to national curricula, encouraging hands-on learning through community projects, and using social media platforms that reach over 90% of people aged 18 to 29 globally. Evidence from Kenya, India, and the Philippines

indicates youth-led campaigns have led to real policy changes, from bans on single-use plastics to municipal climate adaptation plans (Ng, 2021).

The findings suggest that when young people have scientific knowledge, advocacy tools, and access to decision-making spaces, they can drive systemic change. Investing in climate education that emphasizes critical thinking, interdisciplinary learning, and collaboration across generations is not only essential for education but also a strategy for climate resilience. Tapping into the energy, creativity, and moral authority of youth voices provides a powerful path toward a greener, more sustainable future.

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Vertebral deformity in *Schizothorax richardsonii*: First Record from a Coldwater riverine stream in the Central Himalayas

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ABSTRACT

Schizothorax richardsonii, a keystone coldwater species in the Himalayan river systems, commonly referred to as the snow trout, is vital for maintaining ecological equilibrium and sustaining traditional fishing livelihoods. Given that skeletal abnormalities are rare in natural populations of this species, each finding is crucial for understanding environmental influences and fish health. A specimen exhibiting a discernible and distorted curvature of the vertebral column was discovered during a routine ichthyofaunal collection from mountain-fed stream in the Central Himalayas. The abnormality was particularly evident in the caudal region, characterized by pronounced lordosis (upward curvature) and mild scoliosis (lateral curvature). Alterations in spinal alignment may affect an individual's capacity to swim, evade predators, forage effectively, and overall thrive in the wild. The specimen was subjected to comprehensive morphometric analysis, high-resolution photographic documentation, and radiographic imaging to elucidate the internal skeletal structure for the purpose of documenting and describing the anomaly. Simultaneously, measurements of temperature, turbidity, pH, and dissolved oxygen (DO) were conducted at the sampling site. Environmental stresses were identified by a systematic evaluation of habitat features, including substrate type and stream flow velocity. This is the first report of vertebral abnormalities in *S. richardsonii* from an unaltered natural cold-water stream in the Central Himalayas. Genetics, environmental degradation, pollution, nutritional deficiencies, hydrological alterations, or early developmental stressors may all contribute to the emergence of such abnormalities. The observation of rare deformities offers foundational data for assessing bone health in wild cold-water fish populations in the Himalayas. To attain a comprehensive understanding of the root causes and ecological implications of these illnesses, it highlights the

importance of thorough pathology exams, sustained ecological monitoring, and population health evaluations.

Keywords: *Schizothorax richardsonii*, vertebral deformity, lordosis, scoliosis, radiography, and skeletal anomaly.

Evaluating the Phytoremediation Potential of *Salix Species*: A Green Technology for Environmental Sustainability

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ABSTRACT

Environmental pollution from potentially toxic elements (PTEs) like heavy metals is a significant global issue that endangers ecosystems and human health. Traditional remediation methods are often costly and can cause additional environmental damage, highlighting the need for sustainable and affordable alternatives. Phytoremediation, a green technology that utilizes plants to clean up contaminated sites, is a promising solution. This study focused on evaluating the phytoremediation potential of *Salix alba* (a willow species) in the Kashmir valley, known for its rapid growth and tolerance to pollutants. The research aimed to establish a scientific basis for using this natural and sustainable method for environmental restoration. The study was conducted in Srinagar district of Kashmir Himalayas, India. The plant and soil samples were collected from sites where abundant *Salix alba* plants found. The samples were analyzed to determine heavy metal concentrations using an Atomic Absorption Spectrometer (AAS). The plant's remediation capacity was quantified using the Bioaccumulation Factor (BF) and Translocation Factor (TF). The BF measured the plant's efficiency in taking up metals from the soil, while the TF assessed its ability to move these metals from the roots to the harvestable shoots. The results demonstrated significant heavy metal concentrations in the soil, with the highest levels for lead (Pb) at 32.73 mg/kg and zinc (Zn) at 32.25 mg/kg. *Salix alba* showed a strong ability to accumulate both lead and zinc, with high BFs of 2.6 and 2.8, respectively, indicating efficient uptake. The Translocation Factor for lead was 1.0, suggesting it is an effective phytoextractor that moves the metal to its harvestable parts. The plant also displayed robust growth and tolerance under high-stress conditions. These findings suggest that *Salix alba* can serve as an effective phytoextractor, capable of removing and concentrating pollutants in its biomass. The study confirms the promise of *Salix alba* as a viable green technology for the sustainable remediation of heavy metal-contaminated sites.

Keywords: Environment, green technology, heavy metal pollution, phytoremediation, willows

Carbon sequestration by agroforestry systems: A case study of Datia district in MP, India**Aisha Sana¹, Dobriyal J Manmohan² and Rizvi H Raza³,**¹*Birsa Agricultural University, Ranchi, India*²*Rani Lakshmi Bai Central Agricultural University, Jhansi, India*³*ICAR - CSSRI - Regional Research Station, Lucknow, India***ABSTRACT**

Carbon sequestration under agroforestry involves absorption of CO₂ during photosynthesis and its transformation into organic C compound, which can then be transferred to soil pool for long term storage (Nair *et al.* 2010). To combat increase in global warming various researches have been done to estimate carbon capture and storage by different agroforestry system, where carbon is stored in both plant parts and its surrounding soil. The present study, carried out in Datia district of Bundelkhand region, India, analysed both biomass and carbon accumulation using CO2FIX model. Carbon sequestration was simulated for 20 years from baseline year 2021 to simulated year 2041 in agroforestry Systems in the region. CO2FIX model is chosen over other carbon processing models for the reason that it can simulate carbon dynamics for both single and multiple species present in forest and agroforestry system. The dynamic carbon accounting model CO2FIX v3.1 was developed during the CASFORII project and was described in detail by Namburs and Schelhaas (2002), Masera *et al.*, (2003) and Sahelhaas *et al.*, (2004). The basic input to the model is the volumetric growth of the tree in terms of CAI (Current Annual Increment in m³ ha⁻¹ year⁻¹) and primary data such as name and number of tree species, diameter at breast height (DBH), crops grown on farmlands along with their productivity, area coverage, soil organic carbon etc. After parameterizing the CO2FIX model with the collected data, the results are presented in Table 1. Our result revealed that the net carbon sequestered in agroforestry systems over the simulated period of twenty years is 9.31Mg C ha⁻¹ and annually it is 0.46 Mg C ha⁻¹ and accordingly, CO₂ mitigation potential of agroforestry systems is 1.70 tonnes ha⁻¹ yr⁻¹ (Table 1) and additionally, the study also revealed the CO₂ mitigation potential of agroforestry systems for the whole district as 0.32 million tonnes annually, since net sown area of the district is 1,86,700 ha, during the study period. These results shared similarity with a similar study conducted in Agroclimatic zone 8 of India (Rizvi *et al.* 2019), where net carbon sequestered from agroforestry systems came as 9.59 Mg C ha⁻¹ and annually it came as 0.32 Mg C ha⁻¹, where the simulation period was thirty years. Similarly, the CO₂ mitigation potential of agroforestry system at country level in the same study was 1.11 tonnes of CO₂ equivalent ha⁻¹ yr⁻¹ which closely favours our result. The methodology used in this study can be used to assess C sequestration potential of AFS both at regional as well as country level which will further increase the value of such natural resources and initiate us to step forward for increasing the green cover.

Keywords: Agroforestry, Carbon sequestration, Green cover, Global Warming, Carbon accounting

Offerings Becoming Waste: Waste Management Awareness at Religious Places of Vadodara City
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Religious places attract millions of devotees, where religious offerings such as flowers, incense, food, and packaging materials play a central role in spiritual practices. These offerings after fulfilling its purpose become waste, when unmanaged pose significant environmental and public health challenges. The study examines the level of awareness regarding waste management practices among management authorities of the selected religious places. Using a mixed-methods approach, the research explores key factors influencing awareness, including individual knowledge, cultural beliefs, social norms,

institutional support, and accessibility to waste disposal infrastructure. The findings reveal that while many individuals recognize the environmental impact of unmanaged religious waste, their actions are often constrained by traditional customs, lack of information, or inadequate facilities. The study highlights the critical need for culturally sensitive awareness campaigns, improved infrastructure, and active engagement of religious institutions to promote sustainable waste practices at sacred sites. Recommendations are provided for policy makers and local authorities to integrate ecological stewardship into religious traditions, ensuring that sacredness and sustainability coexist harmoniously.

Keywords: Waste Management; Religious places; awareness; sustainability;

Guar gum based functional materials for sustainable industrial practices

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ABSTRACT

The escalating impacts of climate change demand innovative material solutions that are renewable, biodegradable, and environmentally benign. Guar gum, a galactomannan polysaccharide obtained from *Cyamopsis tetragonoloba*, offers exceptional promise as a sustainable alternative to petroleum-based polymers. This study involves introducing Methacryloyl groups into the Hydroxy Propyl Guar gum backbone to improve its physicochemical and structural properties. The structural modifications were confirmed through Fourier Transform Infrared Spectroscopy (FTIR), which identified characteristic functional group transformations. Thermo gravimetric Analysis (TGA) was employed to assess the thermal stability of MAGG, while Scanning Electron Microscopy (SEM) provided insights into the morphological changes induced by the modification. The invented product is superior to guar gum, for application in petroleum, textile printing, paper, food and pharmaceutical Industries. The original fibrous particle structure of Guar gum undergoes a transition to a flake-like morphology due to the modification of methacryloyl chains onto hydroxy Propyl guar gum. This indicates that the granular nature of guar gum is lost after derivatization, resulting in the formation of a flake-like structure. By valorizing an agricultural by-product into high-performance, climate-conscious materials, this research aligns with global sustainability goals and contributes to reducing plastic waste, greenhouse gas emissions, and environmental toxicity.

Keywords: Guar gum, polymer composites, derivatization, sustainable materials

Changing Minds, Healing Earth: Behavioural Shifts Through Feminist Climate Narratives

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ABSTRACT

This paper investigates the potential of feminist narratives in Indian literature to act as a catalyst for pro-environmental behavioral change. Focusing on Anita Desai's novel *Fasting, Feasting* and Ismat Chughtai's short story *Lihaaf*, the research posits that the symbolic portrayal of women's experiences—including their forced silence, emotional resistance, and suppressed defiance against patriarchal systems—serves as a powerful metaphor for ecological oppression. These narratives, often set within domestic spheres, illustrate how the marginalization of women and their intimate connection to their immediate environment mirrors the broader neglect and exploitation of the natural world. These works, therefore, offer a human-centered lens through which to understand and address the climate crisis.

Drawing on established theories of behavioral change and the feminist ethics of care, this study argues that these literary works provide subtle yet potent, non-didactic models for cultivating environmental awareness. They move beyond the traditional, often abstract, discourse of environmentalism to showcase the emotional and psychological

underpinnings of both personal oppression and ecological resilience. The characters' internal struggles and moments of resistance are interpreted not merely as personal triumphs but as fundamental precursors to developing behaviors that prioritize ecological well-being. By exploring themes of profound responsibility, a deep emotional entanglement with one's surroundings, and defiance against oppressive systems, the paper suggests that these narratives provide a compelling framework. This framework fosters a deeper, more personal connection to environmental stewardship, promoting tangible shifts in human behavior towards a more sustainable future by highlighting the shared experience of subjugation and the power of care.

Keywords: Feminist narratives, Indian literature, climate crisis, behavioral change, ecological oppression, feminist ethics of care, environmental stewardship, Anita Desai, Ismat Chughtai.

Disease Studies; Infectious, Viral and Parasitic

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ABSTRACT

Infectious diseases, particularly those of viral and parasitic origin, continue to pose a significant threat to global public health. Despite advances in diagnostic technologies, treatment protocols, and vaccination programs, these pathogens persist as major contributors to morbidity and mortality, especially in low- and middle-income countries. This study investigates the epidemiology, transmission dynamics, and host-pathogen interactions of select viral (e.g., influenza, HIV, SARS-CoV-2) and parasitic (e.g., malaria, schistosomiasis, leishmaniasis) diseases. Through integrative analysis combining molecular biology, clinical data, and public health surveillance, we highlight emerging trends in resistance, zoonotic spillover, and vector adaptation. The study further explores strategies for containment and control, including novel vaccine platforms, vector management, and community-based intervention models. Understanding the complexity of these diseases in the context of ecological, sociopolitical, and evolutionary factors is essential for developing sustainable global health solutions.

Keywords: Infectious diseases, Viral infections, Parasitic diseases

Geospatial Analysis of Urban Sprawl and Land Use/Land Cover Change in Haryana Metropolitan City of Gurugram

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ABSTRACT

Urban sprawl is a complex, multi-dimensional process that transforms economic landscapes, social fabrics, and ecological systems. Gurugram—situated in Haryana and part of the National Capital Region (NCR)—is a paradigmatic example of rapid urbanization driven by economic liberalization, infrastructure investment, and real estate development. This research employs geospatial techniques to quantify and interpret land use/land cover (LULC) changes and urban sprawl in Gurugram over a thirty-two-year period (1991–2023). Multi-temporal Landsat imagery (Landsat 5 TM, Landsat 7 ETM+, Landsat 8 OLI/TIRS) was preprocessed, classified using supervised Maximum Likelihood Classification (MLC), and validated through ground truthing. Post-classification change detection and transition matrices were used to quantify conversions between major LULC classes: built-up, agriculture, vegetation/forest, water bodies, and barren/others. Spatial pattern metrics—including Shannon's Entropy, Patch Density, and Mean Patch Size—were calculated to measure sprawl intensity, fragmentation, and compactness. For future projection, a Cellular Automata-Markov (CA-Markov)

model was calibrated using observed transitions and driver variables (distance to roads, distance to city center, slope, and proximity to built-up patches) to simulate LULC for 2033. Accuracy assessment employed confusion matrices, Producer's and User's accuracy, and Kappa statistics. Results indicate accelerated conversion of agricultural land to built-up forms with built-up cover increasing from approximately 8% (1991) to 46% (2023). Shannon's Entropy rose markedly, signalling growing dispersion and leakage of urban fabric into peri-urban areas. CA-Markov projections forecast further built-up expansion (up to ~58% by 2033) under a business-as-usual scenario. Environmental impacts—groundwater depletion, heat island intensification, loss of biodiversity and wetlands—are analyzed in relation to spatial patterns of change. The study concludes with recommendations for policy, planning, and geospatial monitoring to guide sustainable urban development in Gurugram. The research illustrates how geospatial science can provide actionable evidence for managing rapid urban change while balancing development goals and ecological resilience.

Keywords: Classification, Change Detection, Matrices, Conversions, Landsat

Ecological Restoration Plan of Water Body in Premises of Rajiv Gandhi Zoological Park – Pune, Maharashtra

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ABSTRACT

Katraj Lake, a historic man-made waterbody located within Pune's Rajiv Gandhi Zoological Park, has been an ecological, cultural, and hydrological asset since its construction during the Peshwa era in 1749. Once a crucial freshwater source, the lake is now severely degraded due to unchecked sewage inflow, invasive water hyacinth proliferation, nutrient overloading, and silt deposition. These stressors have resulted in deteriorating water quality, eutrophication, biodiversity loss, and reduced recreational value. This study assesses the current status of Katraj Lake and proposes an integrated ecological restoration strategy. Water quality was analyzed during monsoon and post-monsoon seasons using APHA standard protocols, testing parameters such as pH, turbidity, dissolved oxygen (DO), biochemical oxygen demand (BOD), chemical oxygen demand (COD), total hardness, nitrates, phosphates, and coliform bacteria. Results revealed turbidity far above permissible limits, elevated hardness and alkalinity, and nutrient enrichment conducive to algal blooms, oxygen depletion, and fish mortality.

The proposed restoration plan incorporates mechanical weed removal, sediment dredging, aeration systems (waterfall and air diffusion), riparian zone plantation, rainwater harvesting, and creation of artificial bird nesting habitats. These measures aim to improve water quality, restore hydrological balance, revive aquatic and terrestrial biodiversity, and enhance ecosystem resilience.

Beyond ecological improvements, the plan emphasizes community participation, educational outreach, and sustainable management practices to prevent future degradation. By integrating scientific methodology with stakeholder engagement, this project positions Katraj Lake as a replicable model for urban waterbody restoration in India.

This work demonstrates that evidence-based, community-supported restoration can transform degraded urban lakes into multifunctional assets that protect biodiversity, mitigate climate change impacts, and preserve cultural heritage while enriching public spaces.

Keywords: Katraj Lake, ecological restoration, water quality, invasive species, urban biodiversity conservation

Eco-Friendly Intensification: The Role of Humic Substances in Sustainable Agriculture**Rachna and Renu Gupta***Sher-e-Kashmir University of Agricultural Sciences and Technology-Jammu***ABSTRACT**

Despite the 20th century's green revolution, one of the major issues facing agricultural research is sustaining food production for a growing population without endangering natural resources for future generations. The intensification of agriculture has reached a key threshold, but its detrimental effects are leading to the loss of many ecological services and long-term changes in the global climate. Therefore, new strategies are needed to support sustainable intensification. The use of plant biostimulants based on humic compounds is one possible way to aid in this shift. Biostimulants are potential technology for ecological intensification. Biostimulants is a formulated product of biological origin that improves plant productivity and is a association between the humified matter's chemical characteristics and bioactivity - particularly with regard to promoting lateral root growth. The biostimulants effects of humic compounds are typified by physiological and structural alterations in roots and shoots that are connected to the uptake, assimilation, and distribution of nutrients (nutrient usage efficiency features). They can also cause changes in the primary and secondary metabolism of plants that are linked to their ability to withstand abiotic stress, which together can influence plant development and increase fitness. Humic acids play several important roles such as: increase soil physical and biochemical activities by improving structure, texture, water holding capacity (WHC), and microbial population. In conclusion, humic compounds can be applied exogenously in agronomic systems to support the development of sustainable intensification. The majority of humic materials used in agriculture now come from non-renewable resources like coal and peat, hence advancing this technique also calls for the creation of new sources of humic products that are sustainable (like organic wastes).

Keyword: Food demand, biostimulants, humic substances, soil properties, crop yield

Climate Adaptation Action for Urban Forests and Human Health**Ananya Tripathi***Forest Research Institute – Dehradun, Uttarakhand, India – 248006***ABSTRACT**

Urban spaces are growing more susceptible to the effects of climate change because of their large concentrations of people, large expanses of impervious surfaces, contamination, and concentration of built-up infrastructure. All this increases exposure to climate stressors like urban heat island effects, intense storms, and droughts, which result in severe health risks to physical and mental well-being. Urban forests, which include trees, parks, green corridors, and other vegetative cover, are critical in both climate change mitigation and adaptation. They mitigate greenhouse gas levels, cool ambient temperatures, clean the air, and provide restorative areas improving community health. Urban forests themselves, however, are vulnerable to climate stress and need forward-thinking, adaptive management. This Climate Adaptation Actions for Urban Forests and Human Health report distills findings from numerous peer-reviewed studies and evidence-based reports into a guide for incorporating climate adaptation actions into urban forest management. One of the report's primary outputs is the Urban Forest Climate and Health Adaptation Menu, an adaptable planning tool intended for use by urban forestry professionals, planners, and public health practitioners. The Menu presents a range of adaptation measures—instead of prescription solutions—at several scales that are adaptable to particular urban situations and available planning arrangements. It enables well-informed decision-making, facilitates

intersectoral cooperation, and stimulates the co-benefits of urban greening for climate adaptation as well as human health. By enabling conversation about community values, risks, and adaptation requirements, the Menu is a useful tool to inform planning, policy-making, public outreach, and investment in green infrastructure. The coordination of urban forestry with climate and public health programs is critical to the creation of more resilient, equitable, and sustainable cities amidst accelerating climate change.

Keywords: Urban forestry, climate change adaptation, urban heat island, human health, nature-based solutions, green infrastructure, urban resilience, public health, environmental planning, climate risk management

Effect of Direction of sowing and Phosphorus levels on growth and yield attributes of Toria (*Brassica campestris* L.)

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ABSTRACT

A field experiment was conducted during *Rabi* season 2024 at Crop Research Farm, Department of Agronomy, *Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (U.P.)* on Toria. The soil of experimental plot was sandy loam in texture, low in organic carbon (0.72%), nearly neutral in soil Ph (7.2), Nitrogen (178.48 kg/ha), Phosphorous (27.80 kg/ha), Potassium (233.24 kg/ha). The treatment consist of Direction of sowing (North - South, East - West, Control (NW - SE)) and Phosphorus (50, 60, 70 kg/ha) levels. The experiment was carried out in a randomized block design with ten treatments and were replicated thrice. The results revealed that significantly higher plant height (167.50cm), Number of Branches/plant (15.87), dry weight (31.10 g/plant), number of Siliqua/plant (222.40), number of seeds/Siliqua (19.40), were obtained in East West Direction of sowing and application of Phosphorus at 60kg/ha in Toria crop.

Key words: Toria, Direction, Growth, Yield attributes

Media's Influence on Public Climate Awareness: A Statistical Analysis among College Students in Chengalpattu, Tamil Nadu

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ABSTRACT

Climate change communication plays a pivotal role in shaping public understanding, especially among youth who are future decision-makers. This study examines the influence of media exposure on public climate awareness among college students in Chengalpattu, Tamil Nadu, focusing on the nature, frequency, and impact of media usage. A mixed-methods approach was adopted, integrating quantitative analysis through descriptive statistics, Pearson's correlation, and multiple regression models. Data were collected from a stratified random sample of 320 students across five colleges between January and March 2024, using a structured questionnaire measuring media consumption patterns, knowledge levels, and climate-related attitudes.

Descriptive analysis revealed that 86% of respondents frequently accessed climate-related information through social media, while 62% engaged with television news and 48% relied on online news portals. Correlation analysis indicated a strong positive relationship ($r = 0.74$, $p < 0.01$) between frequency of media exposure and climate awareness scores, suggesting that higher media engagement significantly enhances knowledge levels. Multiple regression analysis demonstrated that social media usage ($\beta = 0.53$, $p < 0.001$) was the strongest predictor of climate awareness, followed by online news portals ($\beta = 0.31$, $p < 0.01$), whereas traditional print media showed no significant predictive effect.

The findings highlight that digital media platforms serve as primary channels for disseminating climate information to youth, influencing both their awareness and proactive attitudes toward sustainability. However, the prevalence of misinformation remains a challenge, necessitating critical media literacy interventions. The study recommends collaborative initiatives between educational institutions, environmental organizations, and media outlets to design targeted campaigns that enhance factual climate knowledge and encourage active participation in environmental protection.

Keywords: Climate change awareness, media influence, social media, statistical analysis, correlation, regression, college students, Chengalpattu, Tamil Nadu

Alternaria leaf blight disease in Faba bean (*Vicia faba* L.): A Pathogenicity Test

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ABSTRACT

Faba bean (*Vicia faba* L.), commonly referred to as horse bean, field bean, wide bean, fava bean, and tic bean, is a member of the *Fabaceae* family. The faba bean is essential to the world's food security. However, a number of diseases that can negatively impact yield and quality impede its production. The objective of this study is to examine the many aspects of disease resistance in faba beans, with an emphasis on creating cultivars that have strong defensive mechanisms against a variety of diseases. The isolated pathogen's pathogenicity was evaluated using faba bean leaves that were growing naturally and in good condition. The disease first manifests as asymmetrical brown patches on the leaf surface, which are followed by dark brown to black dots on the underside. Then they fall and gather together on these locations. A Potato Dextrose Agar (PDA) petri dish was used to collect diseased leaves and isolate fungi from them by separating the diseased parts from the healthy ones. Following the seventh day of incubation, fungal growth was noted at a temperature of 25 ± 1 .

Keywords: Food security, Resistance, Pathogen, Pathogenicity, PDA.

Study the optimum dose of organic sources of nutrients for growth and yield of brinjal (*Solanum melongena* L.)

Manoj Kumar Ahirwar¹ and Dwarka²

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²Department of Entomology, JNKVV, College of Agriculture, Panna, Madhya Pradesh, 488001, India.

ABSTRACT

The present investigation was carried out during the *rabi* season of 2021 and 2022 at Research Farm, KVK (M.P.). Substituting the organic fertilizers with microbial inoculants such as azotobacter, azospirillum, PSB and KSB at different doses of organic fertilizers showed more plant height, number of branches, number of leaves per plant, plant spread from east to west and north to south was at 30, 60 and 90 DAS sowing was found to be maximum in treatment T₁₈-[Vermicompost (3t/ha)+ Azotobacter + PSB + KSB (7.5 L/ha)]. The days taken to first flowering, number of flowers per plant and 50% flowering the treatment T₁₈ -[Vermicompost (3t/ha) + Azotobacter + PSB + KSB (7.5 L/ha)] consistently resulted in the earliest 50% flowering appearance. Treatments T₁₈-[Vermicompost (3t/ha)+ Azotobacter +PSB +KSB (7.5L/ ha)], T₁₇-[Vermicompost (3t/ha)+ Azotobacter +PSB+ KSB (5L/ha)] and T₁₆-[Vermicompost (3t/ha) + Azotobacter+ PSB+ KSB (2.5 L/ha)], which involved the application of vermicompost, Azotobacter, PSB, and KSB, as well as T₉-[FYM(30t/ha)+ Azotobacter+ PSB+ KSB (7.5L/ha)] with FYM, consistently resulted in the earliest first fruit set appearance. Early fruit set is

significant in agriculture as it can potentially lead to higher crop yields and T₁₈ consistently resulted in the earliest fruit harvesting. Treatment T₁₈ resulted in the highest weight, diameter and length of fruit and yield and yield attributes again outperformed other treatments in terms of the number of fruits per plant and fruit yield per plot and per hectare and have a significant positive impact on various yield attributes and fruit characteristics in brinjal crops grown during the Rabi season. Treatment T₁₈-[Vermicompost (3t/ha)+ Azotobacter+ PSB+ KSB (7.5 L/ha)], involving vermicompost, Azotobacter, PSB and KSB, has resulted in the highest ascorbic acid content, shelf life, total sugar of brinjal fruit.

Keywords: Vermicompost, Azotobacter, PSB, organic fertilizers and KSB.

Genetic study of yield attributing traits in advanced breeding lines of Bread Wheat (*Triticum aestivum* L.)

Pradeep Kumar Yadav, R.S. Sikarwar, Sushma Tiwari and M.K.Tripathi

Department of Genetics & Plant Breeding, College of Agriculture, Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior, 474002 M.P., India

ABSTRACT

In India, wheat is the second most important food crop after rice both in terms of area and production. It has been described as the 'King of cereals' because of the acreage it occupies, high productivity and the prominent position it holds in the international food grain trade. It is grown in temperate, irrigated to dry and high- rain-fall areas and in warm, humid to dry, cold environments. Wheat is consumed in a variety of ways such as bread, chapatti, porridge, flour, suji etc. Among several pathogens damaging wheat crop, rust pathogens are the most prevalent They are reported from all wheat growing countries and causes a severe damage to the wheat production worldwide. The present investigation was conducted during *Rabi* season of 2022 at Research Farm, RVSKVV, College of Agriculture, Gwalior (M.P.). The wheat genotypes were examined for rust resistant gene by using the molecular markers SSR and SCAR. The study of the 34 advanced breeding lines. For morphological observations, wheat genotypes were significantly differed for all 15 characters i.e.viz., days 50% heading, days 50% flowering, days to physiological maturity, grain filling period, Number of spikes per plant, length of spike, peduncle length, plant height, flag leaves areas, weight of the spike per plant, number of grains per spike, 1000 seed weight, biological yield per plant, harvest index and grain yield per plant.

Key words: Wheat, rust resistance, morphological characterization.

Efficacy of Fungitoxicants and Biocontrol Agents Against Leaf Spot Disease of Turmeric (*Curcuma longa* L.) Caused by *Colletotrichum capsici*"

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^{2,3}*Department of Plant Pathology, Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya 224 229, U.P., India*

ABSTRACT

Turmeric (*Curcuma longa* L.) is a vital spice crop in India, frequently affected by leaf spot disease caused by *Colletotrichum capsici* (Syd.) Bisby and Butler, resulting in significant yield losses. To identify effective fungicidal control measures, eight fungitoxicants were evaluated under laboratory conditions. Among them, Copper oxychloride (0.2%), Propiconazole (500 ppm), Hexaconazole, and Azoxystrobin were found to completely inhibit fungal growth, with Copper oxychloride and Propiconazole being most effective at lower concentrations. Biological control agent *Trichoderma harzianum* and botanicals like garlic leaf extract and Neem Seed Kernel Extract (NSKE) were moderately effective. Subsequent field trials with nine treatments showed that Propiconazole (T2) was the most effective in minimizing disease intensity (PDI 25.57%) and enhancing yield (343.44 q/ha), followed by Hexaconazole (T3). *Trichoderma harzianum*, Jeevamruth, NSKE, and garlic leaf extract

showed moderate control. Propiconazole also provided the highest economic return (492900 Rs. / ha) and B:C ratio (3.54). Thus, Propiconazole emerged as the most promising fungicide for effective management of turmeric leaf spot disease under field conditions.

Keywords: Turmeric, leaf spot, fungi toxicants, Copper oxychloride, *Trichoderma harzianum*, Disease management

Impact of MGNREGA in terms of socio-economic upliftment of rural people

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ABSTRACT

The National Rural Employment Guarantee Act guarantees employment for more than 54 million rural poor of India for 100 days in a year. The provisions of the Act identifies Panchayati Raj institutions as the key implementing agency for the programme providing a significant opportunity for demonstrating the role of village level institutions in transforming their village infrastructure and addressing abject poverty. The processes are of the scheme have new ways of doing business which include principles of transparency and grass root democracy. It is the largest development programme in the state since its enactment (initiated in 18 districts of state in Feb 2006 and from July 2022 all 52 districts are being covered). Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) was implemented and came into force on February 2, 2006. It was the first act of its kind in the world wherein an economic safety net is provided to around 2/3rd of the population through the right to work. The scale on which it has been provided is just mindboggling, engaging around 1/10th of the total world population. It was second in a series of right based policies Government of India has rolled out in the past decade. The others are the Right to Information (RTI) Act, the Right to Education (RTE) Act, the Right to Food Act *etc.* passed in 2005, 2009 and 2013 respectively. The impact of the scheme is slowly starting to show in the state. People have started to feel that there is some level of impact at the individual household as well as at the panchayat level. An estimated 25.61 lakh households have worked under MGNREGS. Of these, 68% feel that there is an impact of MGNREGS on the quality of life of the poor. The increase in income through additional wages is very little. The meager increase in income does not contribute much in the economic condition of the household.

Keywords: MGNREGS, Right to Food Act, Government of India, Right to Information, economic safety and policies Government of India.

The effects of artificial light on off - season dragon fruit production

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ABSTRACT

Artificial lighting plays a crucial role in enhancing off season flowering in dragon fruit production, particularly in regions with short daylight periods. By extending the photoperiod, dragon fruit plants can be induced to produce flowers and fruits during off-seasons. Optimal Lighting Duration 6 hours of artificial lighting has been found effective for off-season dragon fruit production, with the best results achieved using a 100W incandescent bulb. The average light intensity of 225.96 lux has shown superior performance in promoting bud formation, fruit length, and yield. Type of lighting viz. Compact Fluorescent Lamps (CFLs) and Light Emitting Diodes (LEDs) are suitable options for artificial lighting, with LEDs potentially offering higher profits due to lower production costs. Climate Considerations as

Dragon fruit cultivation can thrive in arid and semi-arid climates, enhancing agricultural productivity in water-scarce regions and improving land use efficiency. More Benefits and Challenges of Artificial Lighting - Increased Yield: Artificial lighting can significantly increase dragon fruit yields, making it a valuable technique for farmers. Energy Consumption: However, excessive nighttime illumination can lead to increased energy consumption and greenhouse gas emissions. Environmental Impact: The potential environmental hazards associated with light pollution warrant further attention and management. "Under natural conditions, dragon fruit plants failed to produce flowers due to short day length. However, supplementing with 6 hours of artificial lighting using a 100W incandescent bulb from 6 pm to 12 am proved to be the superior method for inducing off-season flowering and production."

Keyword: Dragon fruit, CFL, LED and Yield

Alternaria leaf blight disease in Faba bean (*Vicia faba* L.): A Pathogenicity Test

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ABSTRACT

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Keywords: Food security, Resistance, Pathogen, Pathogenicity, PDA.

Study the optimum dose of organic sources of nutrients for growth and yield of brinjal (*Solanum melongena* L.)

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Keywords: Vermicompost, Azotobacter, PSB, organic fertilizers and KSB.

Genetic study of yield attributing traits in advanced breeding lines of Bread Wheat (*Triticum aestivum* L.)

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ABSTRACT

In India, wheat is the second most important food crop after rice both in terms of area and production. It has been described as the 'King of cereals' because of the acreage it occupies, high productivity and the prominent position it holds in the international food grain trade. It is grown in temperate, irrigated to dry and high- rain-fall areas and in warm, humid to dry, cold environments. Wheat is consumed in a variety of ways such as bread, chapatti, porridge, flour, suji etc. Among several pathogens damaging wheat crop, rust pathogens are the most prevalent They are reported from all wheat growing countries and causes a severe damage to the wheat production worldwide. The present investigation was conducted during *Rabi* season of 2022 at Research Farm, RVSKVV, College of Agriculture, Gwalior (M.P.). The wheat genotypes were examined for rust resistant gene by using the molecular markers SSR and SCAR. The study of the 34 advanced breeding lines. For morphological observations, wheat genotypes were significantly differed for all 15 characters i.e.viz., days 50% heading, days 50% flowering, days to physiological maturity, grain filling period, Number of spikes per plant, length of spike, peduncle length, plant height, flag leaves areas, weight of the spike per plant, number of grains per spike, 1000 seed weight, biological yield per plant, harvest index and grain yield per plant.

Keywords: Wheat, rust resistance, morphological characterization.

Physico-chemical factors influence on niger [*Guizotia abyssinica* (L.f.) Cass.] genotypes of abundance about different bee species

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ABSTRACT

An experiment was conducted at Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, Madhya Pradesh, India during *Rabi* session- 2021 and 2022. Study the role of different physico-chemical factors of niger crop on the occurrence of different species of pollinators, 26 diversified genotypes of niger were grown and population of different pollinators visited on each genotypes were recorded at 3, 10, 17, 24, 31, 38 and 45 days after flowering. The highest population of *Apis cerana indica*, *Apis mellifera*, *Apis dorsata*, *Apis florea* and other pollinators was recorded on genotype T₅-NRS-2015 and

T₆-IGPN-20 (2.50), T₂₀-KBN-2 (1.72), T₂₄-JNC-6 (9.05), T₁₄-PC-2021-1 (2.93) and T₂-CTPN-1 (4.18) individuals/5 minutes/plant, respectively. The significantly highest brix of total soluble solid (30.17 °Brix), total sugar (93.33 mg/g), reducing sugar (0.20 mg/g) and non-reducing sugar (93.14 mg/g) was recorded from the flowers of JNC-1 (T₂₆), JNS-28 (T₂₂), IGPN-2004-1 (T₂₁) and JNS-28 (T₂₂), respectively. From the results it confirmed that all the pollinators were attracted to yellow colour flowers but there was no any significant impact were recorded in between different groups of yellow-colored flowers group.

Keywords: Reducing sugar, JNS-28, biochemical, total soluble solid and *Apis* spp.

Efficacy of Fungitoxicants and Biocontrol Agents Against Leaf Spot Disease of Turmeric (*Curcuma longa* L.) Caused by *Colletotrichum capsici*

Anand Milan¹, Pradip Kumar² and Shyam Narayan Patel³

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Keywords: Turmeric, leaf spot, fungitoxicants, Copper oxychloride, *Trichoderma harzianum*, Disease management

Role of Non-Timber Forest Products in Enhancing Rural Livelihood of Korba District

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ABSTRACT

Korba district of Chhattisgarh, situated within the central Indian forest belt, is endowed with rich biodiversity and a wide variety of Non-Timber Forest Products (NTFPs) that play a crucial role in sustaining rural livelihoods. The majority of the district's rural and tribal population is directly dependent on forest resources for subsistence, seasonal employment, and supplementary income. Key NTFPs of the region include tendu leaves (*Diospyros melanoxylon*), sal seeds (*Shorea robusta*), mahua flowers and seeds (*Madhuca longifolia*), chironji seeds (*Buchanania lanzan*), lac (*Kerria lacca*), tamarind (*Tamarindus indica*), gums, medicinal plants, and bamboo. These products are collected either for household consumption or sold in local and regional markets, forming a significant component of

the forest-based economy. This study examines the role of NTFPs in enhancing rural livelihoods in Korba district by analyzing their contribution to household income, food security, and socio-cultural practices. Findings indicate that NTFP collection serves as a vital safety net during agricultural lean periods, mitigating the impacts of crop failure and market volatility. Moreover, traditional ecological knowledge plays a significant role in the sustainable harvesting and utilization of these resources. Despite their potential, the NTFP sector in Korba faces challenges such as overexploitation, declining availability of certain species, limited value addition, inadequate storage and processing facilities, and market dependence on middlemen. Institutional interventions like the Minor Forest Produce Federation, Self-Help Groups, and cooperative marketing have shown promise but require further strengthening. The study underscores that sustainable management, community participation, improved market linkages, and capacity-building initiatives are essential to enhance the economic returns and ecological sustainability of NTFPs in Korba district. Promoting value-added processing, ensuring fair price mechanisms, and integrating NTFP-based livelihood strategies into forest management plans can significantly improve income stability and resilience among rural households while contributing to biodiversity conservation.

Keywords: Korba District, Non-Timber Forest Products, Rural Livelihoods, Sustainable Harvesting, Market Linkages, Chhattisgarh.

Identification and Isolation of Pathogenic Bacteria from the Gills of Freshwater Fish (*Labeo rohita*)

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ABSTRACT

Aquaculture products can contain harmful bacteria that are part of the normal microflora. Microbial infections linked to fish can be transmitted to humans who consume or handle these fish. Biochemical studies on certain growth media were used to figure out what kinds of bacteria were present. Different harmful bacteria were extracted from the fish species, displaying traits such as yellow or white colouring, diminutive sizes akin to pinheads, and some presenting circular or irregular forms that proliferated across the media. The bacteria found in the freshwater fish *Labeo rohita* are *Staphylococcus aureus*, *Escherichia coli*, *Streptococcus spp.*, *Pseudomonas aeruginosa*, and *Salmonella spp.* The detection of *E. coli* and *Salmonella* indicates faecal and environmental contamination, likely resulting from industrial and sewage waste entering freshwater bodies from which fish are caught for commercial sale. The presence of *Staphylococcus aureus*, *Streptococcus spp.*, and *Pseudomonas* is associated with foodborne intoxication and infection. The total plate count (TPC) for the fish samples of *Labeo rohita* was found to be 26.8×10^4 CFU/g for *Staphylococcus aureus*, 18.6×10^4 CFU/g for *E. coli*, 6.2×10^3 CFU/g for *Streptococcus spp.*, 12.8×10^4 CFU/g for *Pseudomonas aeruginosa*, and 7.1×10^3 CFU/g for *Salmonella spp.*, all from the gills of freshwater fish. The increased total plate count in *Labeo rohita* suggests that this species is more likely to get sick. This study presents significant insights into the bacterial diversity of gills in freshwater fish, enhancing the comprehension of fish health and the broader aquatic ecology. The isolation and identification of these bacteria enhance our understanding of the microbial ecology related to freshwater fish gills and underscore possible health ramifications for both aquatic creatures and human consumers.

Keyword: Aquaculture, *Staphylococcus aureus*, *Labeo rohita*, *Pseudomonas aeruginosa*, isolation & identification and Pathogenic bacteria.

Agriculture, Food Security and Water Resources**Rahul¹, Renu Gupta² and Vikas Sharma³**^{1,2,3}*Division of Soil Science and Agricultural Chemistry, Sher-e-Kashmir University of Agricultural Science and Technology, Jammu***ABSTRACT**

Agriculture is a vital driver of global food production, rural livelihoods, and economic growth, yet it faces mounting pressures from population expansion, climate variability, and the overexploitation of natural resources. Among these, the sustainable management of water resources stands out as a critical factor in ensuring long-term food security. Agriculture consumes approximately 70–80% of global freshwater withdrawals, making it both a primary user and a key influencer of water availability for other sectors. However, growing demand, inefficient irrigation methods, soil salinization, and water pollution are placing unprecedented strain on freshwater systems, directly threatening agricultural productivity and, by extension, the stability of food supplies. This presentation examines the complex interdependence between agriculture, food security, and water resources. It will address how unsustainable farming practices, coupled with the impacts of climate change such as erratic rainfall, prolonged droughts, and increased evapotranspiration are intensifying the competition for water and undermining the resilience of food systems. Case studies from diverse agro-ecological zones will illustrate these challenges and highlight successful interventions, including precision irrigation, crop diversification, drought-tolerant varieties, and integrated water resource management (IWRM) approaches. Furthermore, the session will discuss policy and governance frameworks that can balance agricultural needs with environmental conservation, ensuring equitable access to water for farming communities while safeguarding ecosystems. Emphasis will be placed on technological innovations, community-driven water stewardship models, and cross-sectoral collaborations that can help transition toward sustainable agricultural systems. By understanding the dynamic relationships between water management, agricultural practices, and food security, stakeholders from policymakers and researchers to farmers and industry leaders can work together to build resilient, climate-adaptive food systems. Such strategies are essential not only for meeting current nutritional needs but also for securing water and food resources for future generations in an era of increasing environmental uncertainty.

Keywords: Agriculture, Pollution, Evapotranspiration, Precision irrigation, sustainable agriculture

Influence of weather parameters on Alternaria leaf blight disease of sunflower incited by *Alternaria helianthi***Poornima¹ Vikas V. Kulakarni² Shreevani G.N.³ Vijaykumar N. Ghante⁴ and Umesh M.R.⁵**^{1,2,4,5} *AICRP (Sunflower) MARS, Raichur, UAS, Raichur-584 104. Karnataka*³ *ICAR –Krishi Vigyan Kendra UAS, Raichur-584 104. Karnataka***ABSTRACT**

Sunflower (*Helianthus annuus* L.), is one of the most important oilseed crops grown throughout the year across India. Sunflower is a newly introduced oilseed crop in India. In India, Karnataka is the leading producer of sunflower, which are mostly grown as arable crops with little irrigation support, followed by Andhra Pradesh, Maharashtra, Bihar, Odisha and Tamil Nadu. However, sunflower farming has been hampered due to various biotic stresses especially diseases at critical stages of development. Alternaria leaf blight is one of the major diseases caused by *Alternaria helianthi* and seed yield losses were reported upto 80%. Once infected, the symptoms appear on the bottom leaves and consist of small, irregular, dark necrotic spots; gradually, the spots spread to the stem, petiole, and also bracts of faceplate. Due to the frequent occurrence of congenial climatic conditions favourable for

the disease epidemics i.e., high relative humidity and temperatures between 25°C and 30°C leads to disease development. Information on effect of sowing dates and influence of weather factors on development of disease can help in further refining disease management strategies. A field study was conducted on impact of weather parameters on Alternaria leaf spot of sunflower during kharif, for four years i.e., 2021-22, 2022-23, 2023-24, 2024-25 at MARS, Raichur with four different dates of sowing, using one cultivars KBSH-44 and the disease was recorded at weekly interval. Influence of weather parameters on PDI corresponding to the same week or previous week were observed and the conditions like moderate temperatures, relative humidity (RH-I>80% and more RH-II), more rainfall and crop age have more influence on disease development.

Keywords: Sunflower, Disease, PDI and Kharif Crop

Unlocking The Best Avocados: Yield and Quality Insights from Diverse Genotypes

Venkata Rao

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ABSTRACT

Around 20 genotypes were selected from the survey using purposive sampling and interview methods during the year 2019 to 2022. The pattern of variability exhibited by the genotypes for various characters was substantially disparate. Pyriform, obovate and narrowly obovate fruit shapes and light green fruit colour were found to be dominant among the genotypes. The genotypes MYH-1 exhibited good fruit characters like fruit weight (507.33g), fruit length (14.09cm), fruit volume (530ml) and pulp weight (447.67g). MMS-1, though small in size, showed highest fruit thickness (21mm) and pulp:seed ratio (13.7) due to low seed percentage. SGR-6 had highest amounts of total sugars (2.07%) and lowest fat content (4.74%). The genotypes SKA-2 had highest number of fruits (550) with high TSS (9.17⁰B). SGR-3 had highest fat content (10.2%). Fruit diameter ranged from 5.95 cm in SKA-1 to 9.65 cm in SGR-2. Length of the seed varied from 3.06 cm in SGR-6 to 5.44 cm in VRA-1. The range of seed diameter varied between 2.42 cm in MMS-1 and 5.98 cm in VMS-9. Length of seed cavity ranged from 3.83 cm in MMS-1 to 7.04 cm in VMS-2. Diameter of seed cavity varied between 4.09 cm in SKA-1 and 6.6 cm in VMS-1. Seed weight ranged between 9.80 g in MMS-1 and 98.33 g in VMS-9. The characters exhibited by the ecotypes resembled either West Indian race or Guatemalan race, most of them leaning towards West Indian. The results indicated the predominance of West Indian race and probable natural crosses between West Indian and Guatemalan trees, resulting in the representation of characters of both the races.

Keywords: Yield, Genotype and Sustainability

Effect of Natural Bio-based Coatings on Mechanical Performance of Bagasse Pulp Plates"

Pooja M. E., Madhusudhan Nayak C, Hanumantharaju K N and Anusha M B Chennappa Gurikar

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ABSTRACT

Bagasse pulp, a fibrous residue generated during sugarcane processing, has emerged as a promising raw material for manufacturing biodegradable tableware due to its abundance, low cost, and environmental compatibility. Despite these advantages, bagasse pulp exhibits high hydrophilicity, which adversely affects its mechanical strength and functional performance, particularly in contact with moist or oily foods. This study aims to enhance the structural and barrier properties of molded bagasse pulp plates through the application of natural bio-based coatings, including beeswax, carnauba wax, chitosan, and

starch–polylactic acid (PLA) blends. Both coated and uncoated plate samples are fabricated and subjected to standardized testing for tensile strength, burst strength, and tear resistance, alongside evaluations of water absorption, oil resistance, and surface hydrophobicity. The selected coating materials are biodegradable, food-safe, and derived from renewable sources, aligning with sustainability goals. It is anticipated that the application of these coatings will significantly improve mechanical durability, reduce moisture and oil penetration, and enhance the overall service life of the plates without compromising their compostability. The outcomes of this research are expected to contribute to the development of commercially viable, environmentally responsible alternatives to single-use petroleum-based food service products, thereby promoting sustainable packaging solutions

Keywords: Bagasse, Biodegradable tableware, Bio-based coatings, Mechanical strength
Acute Toxicity of Chlorpyrifos, Bifenthrin, and Deltamethrin on *Cyprinus carpio* and

***Ctenopharyngodon Idella*: Behavioural and Histopathological Assessment**

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ABSTRACT

Aquaculture plays an important role in meeting global food demand and supporting livelihoods, but its sustainability is threatened by pesticide contamination in aquatic environments. Pesticide contamination in aquatic ecosystems poses a significant threat to non-target organisms, including ecologically important fish species. This study evaluates the acute toxicity of chlorpyrifos, bifenthrin, and deltamethrin on Common carp (*Cyprinus carpio*) and grass carp (*Ctenopharyngodon Idella*). Fish were exposed for 96 hours in 4 groups (controls and three treatment groups). Behavioural changes included erratic swimming, loss of equilibrium, and rapid operculum movement. Exposure to these pesticides resulted in marked physiological stress, increased mortality, and histopathological damage such as cellular degeneration, necrosis, and tissue disorganization in liver, kidney, and muscle tissues. Notably, lethal concentrations were identified as 0.1 ml (0.004 ppm) of deltamethrin at 80 hours, 6.25 ml (0.25 ppm) of chlorpyrifos at 96 hours, and 0.15 ml (0.006 ppm) of bifenthrin at 35 hours under experimental conditions. LC₅₀ values indicated pesticide and species-specific sensitivity. The study demonstrates that even low concentrations of these pesticides can lead to significant behavioural and physiological changes, negatively affecting fish health and threatening aquaculture sustainability. These results highlight the urgent need for careful management of pesticide use in aquaculture environments.

Keywords: Common Carp, Grass Carp, Pesticides, LC₅₀, Histopathology

Climate Change- Challenges and Mitigation

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Introduction

Climate change is no longer a distant threat—it is a present-day reality. Defined as long-term alterations in temperature, precipitation, wind patterns, and other elements of the Earth's climate system, climate change has become one of the most urgent and complex challenges facing humanity. It is primarily driven by the increase in greenhouse gases (GHGs) due to human activities, particularly carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O) emissions.

Scientific evidence confirms that global temperatures are rising at an alarming rate. According to the Intergovernmental Panel on Climate Change (IPCC), the Earth has already warmed by approximately 1.1°C above pre-industrial levels, and the consequences of even this modest increase are profound.

Understanding the challenges posed by climate change and identifying effective mitigation strategies is critical for securing a sustainable future.

I. Causes of Climate Change

1. Greenhouse Gas Emissions

The primary cause of recent climate change is the accumulation of GHGs in the atmosphere:

Burning of fossil fuels (coal, oil, and natural gas) for electricity, transport, and industry.

Deforestation, which reduces carbon absorption and adds CO₂ to the atmosphere.

Agricultural practices, especially livestock farming, contribute significant methane emissions.

Industrial processes release various gases, including fluorinated gases with high global warming potential.

2. Land Use Changes

Urbanisation, deforestation, and conversion of forests to farmland alter natural carbon sinks and increase surface albedo, contributing to global warming.

II. Challenges Posed by Climate Change

Climate change creates wide-ranging challenges that affect every region of the world, though their severity varies based on geography, development, and resilience capacities.

1. Environmental Challenges

Rising temperatures are leading to the melting of glaciers and polar ice caps, resulting in sea-level rise.

Ocean acidification is damaging coral reefs and marine ecosystems.

More frequent and intense natural disasters—heatwaves, hurricanes, floods, and droughts—are becoming common.

Biodiversity loss as many species cannot adapt quickly to the changing environment.

2. Economic Challenges

Damage to infrastructure from extreme weather events increases repair and reconstruction costs.

Reduced agricultural productivity, threatening food security and rural livelihoods.

Strain on water resources due to erratic rainfall patterns and droughts.

Disruption of global supply chains, tourism, and insurance industries due to climate volatility.

3. Social and Health Challenges

Climate-induced migration creates pressure on urban areas and increases risks of conflict.

Public health issues arise from heat stress, respiratory problems, waterborne diseases, and vector-borne illnesses like malaria and dengue.

Inequity and injustice, as marginalized communities often suffer the most but contribute the least to emissions.

III. Mitigation Strategies for Climate Change

Mitigation refers to efforts to reduce or prevent the emission of GHGs and enhance carbon sinks. A combination of technological innovation, policy measures, lifestyle changes, and global cooperation is essential.

1. Transition to Renewable Energy

Solar, wind, hydro, and geothermal energy can replace fossil fuels in power generation.

Decentralized energy systems like rooftop solar panels promote energy access in rural areas.

Battery storage and smart grids enhance reliability and efficiency.

2. Energy Efficiency

Building insulation, energy-efficient appliances, and industrial optimization reduce consumption.

Green architecture and urban planning can lower energy use and carbon footprint.

3. Sustainable Transportation

Promoting electric vehicles (EVs) and expanding public transport networks.

Encouraging non-motorized transport such as cycling and walking.

Adoption of biofuels and hydrogen fuels as cleaner alternatives.

4. Nature-Based Solutions

Afforestation and reforestation to absorb CO₂.

Wetland and mangrove restoration to act as carbon sinks and buffers against storms.

Agroforestry and regenerative agriculture to improve soil carbon storage.

5. Carbon Capture and Storage (CCS)

Technologies that capture CO₂ emissions from industrial sources and store them underground can help reduce atmospheric GHG levels, though scalability and cost remain concerns.

6. Sustainable Agriculture

Precision farming, drip irrigation, and organic methods reduce emissions and enhance resilience.

Climate-resilient crops and diversified farming reduce vulnerability to extreme weather.

7. Circular Economy

Reducing waste, recycling materials, and designing products for longevity minimize emissions from production and landfills.

IV. International and National Mitigation Efforts**1. Global Agreements**

Paris Agreement (2015): A landmark treaty where countries committed to limiting global warming to well below 2°C, with efforts to limit it to 1.5°C.

Kyoto Protocol: An earlier agreement targeting emissions reductions in industrialized nations.

COP Conferences: Annual summits under the UNFCCC to review progress and enhance commitments.

2. Climate Finance and Technology Transfer

Developed countries pledged to provide \$100 billion annually to help developing nations adapt to and mitigate climate change.

Promotion of green technologies, early-warning systems, and resilient infrastructure in low-income nations.

3. Nationally Determined Contributions (NDCs)

Each country outlines its plans and targets for emissions reduction, often including renewable energy adoption, forest conservation, and industrial regulation.

V. The Role of Individuals and Communities

While policy and technology are critical, individual and community actions are equally important:

Reducing energy use, conserving water, and minimizing food waste.

Using public transport, cycling, or carpooling.

Supporting sustainable products and businesses with low environmental impact.

Environmental education to increase awareness and behavioral change.

Conclusion

Climate change is a multifaceted crisis that threatens the foundations of human civilization and the planet's ecological balance. However, it is also a powerful catalyst for global transformation. The challenges it poses are formidable, but not insurmountable. Through decisive action, innovative technologies, strong policy frameworks, and a collective commitment to sustainability, the worst impacts of climate change can still be avoided.

Mitigation must be pursued in tandem with adaptation strategies to protect vulnerable communities and ecosystems. The window for effective action is rapidly closing, but with a shared vision and sustained effort, a resilient and low-carbon future remains within reach.

Content analysis of English textbooks of CBSE with reference to climate change**Nisha Chandel***School of Education Sanskriti University, India***ABSTRACT**

With the change in global scenario of climate change there is need to change the content which is being taught to the students with reference to environment. This Study focuses on qualitative content analysis of English textbooks prescribed by Central Board of School Education (CBSE) New Delhi, India for classes VI to XII. The objective is to find out how the issues of climate change, environmental awareness and environmental sensitivity are addressed in these text books. While these text books are holding content, which may inculcate values like sympathy, love, peace, and critical thinking but it's potential to prepare students for environmental change, inculcate environmental awareness, environment sensitivity and is underutilised. The study finds significant gaps in CBSE curriculum with reference to climate change and sustainability highlighting the need for more relevant and meaningful integration of environmental themes. This research concludes curriculum-based recommendations that align with any national education policy (NEP)2020 and global sustainability goals.

Keywords: CBSE curriculum, for environmental change, inculcate environmental awareness, environment sensitivity.

Agri-startup for supporting and Scaling Urban Farming in India**Rakesh Rathore***School of Business Studies, Punjab Agricultural University, Ludhiana-141004***ABSTRACT**

Urban farming is the cultivation of agricultural and horticultural crops in urban and peri-urban areas like towns and cities. The startups are not only generating new job avenues, which create more employment. Startups play a key role in problem solving and promoting innovation in the society. Through innovation, the startups are providing easy solutions to problems in the urban areas. Successful startups typically start with mentorship and technological and managerial support. The agri-startup is emerging in urban farming because there is a need. There is a pressing requisite to make urban agriculture feasible for sustainability. Urban agriculture cannot fulfill the food demand of the nation, but for home consumption and environmental sustainability, it is important. Interested people take it as passion. Agility and business model innovation in urban farming can boost the economy of the nation. Lack of knowledge, skill, and funds are the barriers to creating a startup ecosystem in urban farming. The aim of the paper is to highlights agri-startup perspectives in urban farming. The paper is based on secondary sources of data and information. Secondary information has been collected from various research papers, magazines, newspapers, websites, etc.

Keywords: Agri-startup, Urban farming, Perspectives, Job creation

Analysis of the spatial and temporal patterns of thunderstorm activity in Northern India through satellite remote sensing methods.**Rolly Singh, Vikram Singh¹ and Alok Sagar Gautam²**¹*Department of Physics Agra College, Agra, Dr Bhimrao Ambedkar University, Agra, Uttar Pradesh, India.*²*Himalayan Atmospheric and Space Physics Research Laboratory (HASPRL), Department of Physics, Hemvati Nandan Bahuguna Garhwal University, Srinagar Garhwal, Uttarakhand, India.***ABSTRACT**

This study investigates the spatial and temporal patterns of thunderstorm activity in Northern India using satellite remote sensing methods. Thunderstorms are a critical meteorological phenomenon that can have significant impacts on weather, agriculture, and infrastructure. By leveraging advanced satellite remote sensing technologies, this research aims to provide a comprehensive analysis of thunderstorm distribution and variation over time across the Northern Indian region. Satellite data offers high-resolution, wide-area coverage, enabling detailed observation of storm events, and their frequency, intensity, and movement patterns. We examined various factors, including surface temperature, Convective Available Potential Energy (CAPE), sensible heat flux (SHF), wind speed, and total precipitation. Lightning activity reached its highest flashes in May, a dramatic rise from March's flashes. February also saw significant lightning with flashes, driven by robust surface thermodynamics, whereas June experienced reduced lightning due to monsoonal shifts affecting atmospheric conditions. CAPE and wind speed played a crucial role in lightning activity, with their trends closely correlating with flash counts from January to February and March to April. Rainfall in January, April, and June notably impacted lightning frequency, resulting in fewer flashes. Spatial analysis indicated that January's lightning was concentrated in the Himalayan foothills and southern Uttar Pradesh. Despite a low K-Index (up to 20 K), increased SHF contributed to instability. In February, lightning was predominant in the Indo-Gangetic plains, with SHF between 15-75 W/m² enhancing thunderstorms. March saw lightning concentrated in the Himalayan foothills and western Ladakh, despite high CAPE (500 J/kg) and K-Index (30 K), reflecting a strong influence. April experienced an eightfold increase in lightning activity, driven by CAPE, K-Index, and SHF, demonstrating their complex interactions. May's lightning peaked at 1856 flashes, supported by CAPE at 1000 J/kg, a high K-Index (20-30 K), and SHF (135 J/kg), which intensified the activity. In June, lightning remained localized but continued with elevated CAPE, K-Index, and SHF. This analysis combines satellite imagery with meteorological data to identify trends and anomalies in thunderstorm activity. The findings are expected to enhance understanding of thunderstorm dynamics in the region, contribute to improved forecasting models, and support better preparedness and response strategies for weather-related hazards.

Keywords: Lightning Activities, PCA, K- Index, CAPE, SHF, IGP.

Agroforestry as a Nature-Based Strategy for Climate Resilience and Environmental Conservation
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ABSTRACT

Agroforestry, the deliberate integration of trees with crops and/or livestock, offers a multifunctional land-use approach that addresses the dual challenges of climate change adaptation and environmental conservation. This study synthesizes empirical evidence and field-based observations to assess the role of agroforestry systems in enhancing climate resilience, improving ecosystem services, and supporting sustainable livelihoods. The analysis focused on key performance indicators including microclimatic regulation, soil health, biodiversity conservation, carbon sequestration, and water-use efficiency. Results from diverse agroecological contexts indicate that agroforestry can moderate temperature extremes by 2-4 °C, increase soil organic carbon stocks by 15-30% relative to monoculture systems, and enhance habitat diversity for pollinators and other beneficial fauna. Additionally, tree-crop-livestock interactions improve nutrient cycling, reduce erosion, and buffer agricultural productivity against climatic variability. Beyond ecological benefits, agroforestry diversifies income streams and strengthens livelihood security, making it a cost-effective, scalable, and sustainable strategy. The findings underscore the potential of agroforestry as a nature-based solution that synergistically advances climate resilience, environmental conservation, and rural development objectives.

Keywords: Agroforestry, nature-based solutions, climate adaptation, soil organic carbon, biodiversity, ecosystem services

Avian Responses to Climate Variability: Early Warnings from a Changing Ecosystem in Rajgir Wildlife Sanctuary, Bihar, India

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ABSTRACT

The Rajgir Hills, nestled within the Eastern Indo-Gangetic plains of Bihar, constitute a vital ecological corridor connecting the Gangetic basin with the Chotanagpur Plateau. This study investigates how climate variability is subtly yet profoundly influencing avian community patterns in the Rajgir Wildlife Sanctuary (RWS). Over the course of a year-long survey from January to December 2023, systematic sampling across 94 fixed transects revealed a high degree of species turnover, even within a relatively compact spatial extent—suggesting notable shifts in bird assemblages potentially driven by changing climatic conditions.

Through transect surveys across varied habitats, ranging from dry deciduous forests and scrublands to rocky hill slopes and riparian patches—we documented more than 120 bird species. A closer look revealed telling changes in the presence, abundance, and seasonal behaviour of key species, especially insectivores and altitudinal migrants like the Tickell's Leaf Warbler (*Phylloscopus affinis*), Indian Paradise Flycatcher (*Terpsiphone paradisi*), and Verditer Flycatcher (*Eumyias thalassinus*). These birds showed a marked decline during years of erratic monsoon and prolonged heatwaves.

The year 2023, with rainfall nearly 29% below average, witnessed a noticeable dip in ground-nesting and forest-dependent birds. On the other hand, urban-resilient species such as the Common Myna (*Acridotheres tristis*) and House Crow (*Corvus splendens*) held their ground or even increased, pointing to a worrying trend of ecological homogenisation.

Seasonal shifts in the flowering and fruiting cycles of native trees like *Ficus* and *Terminalia* further affected frugivores, while altered wetland conditions saw fewer waterbirds. The emerging pattern is clear: birds are serving as early-warning indicators of ecosystem stress. If such climate anomalies persist, the sanctuary could face a silent erosion of both species richness and ecological roles. The need of the hour is long-term monitoring and community-driven habitat stewardship to safeguard the rich birdlife of this ancient and culturally significant landscape.

Keywords: Altitudinal migrants, Bioindicators, Bird diversity, Climate variability, Ecological homogenisation, Rajgir Wildlife Sanctuary

Evaluation Of Major Agro-Meteorological Indices of Rapeseed Grown With Climate Change Adaptation Measures Under Western Terai Agroecology of Nepal

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ABSTRACT

The study evaluated the agro-meteorological indices of rapeseed grown with climate change adaptation measures in Siyari Rural Municipality, Rupandehi, in western Terai region of Nepal. Farmers have adopted strategies such as adjusting planting times, changing crop varieties, and using conservation agriculture practices like mulching to cope with climate changes. Historical weather data analysis (1992/93-2022/23) showed an increasing rainfall trend of approximately 31.74 mm per year and a decreasing temperature trend of approximately 0.0521°C per year. Rapeseed cultivars planted on different dates (October 15, October 25, and November 5) were assessed using crop cuts from farmers' fields and meteorological data from October 2023 to February 2024. The sowing date significantly influenced the yield of Brassica cultivars, with the highest seed yield (6262.53 kg/ha) recorded for the October 15 sowing date. This planting date also showed the highest Growing Degree Days (GDD) and Pheno-thermal Index (PTI). Heat Use Efficiency was 15.85 kg/°C for October 15, compared to 8.45 kg/°C for October 25. Early planting of rapeseed capitalizes on favourable conditions such as stable heat, adequate sunlight, and beneficial Helio-thermal conditions, resulting in higher and more consistent yields. These agro-meteorological indicators are valuable for forecasting the growth stages, development, and yield potential of rapeseed. However, further studies in different agro-ecological regions are needed to validate and expand these findings.

Keywords: Argo-meteorological indices, Climate change, Crop cuts, Western Terai, Rapeseed

Innovative Approaches to Natural Resource Conservation for Sustainable Development **Muneshwar Prasad Mandal**

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ABSTRACT

The foundation of sustainable development is made up of natural resources, which sustain ecosystems, livelihoods, and life. But the long-term availability of these resources is in jeopardy due to unsustainable exploitation, climate change, and growing human pressures. Thus, creative methods are necessary to guarantee their preservation and long-term use. To preserve soil, water, biodiversity, and forest

resources, this paper focuses on contemporary, science-based, and community-driven approaches that present promising answers. The monitoring, mapping, and management of resources are being revolutionized by technological advancements like artificial intelligence (AI), geographic information systems (GIS), and remote sensing. The best possible use of water and nutrients is made possible by precision agriculture techniques, which also reduce waste and increase productivity. In areas vulnerable to drought, watershed management and rainwater collection help to preserve soil and ensure water security. By integrating trees with crops and livestock, agroforestry systems improve livelihoods, sequester carbon, and increase biodiversity. Moreover, conservation strategies are more effective when traditional ecological knowledge is combined with contemporary scientific methods. Programs for awareness-raising, capacity-building, and community involvement are essential to the effective execution and ownership of these interventions. Long-term conservation goals are further ensured by institutional coordination, policy support, and sustainable financing methods. The study highlights the necessity of an interdisciplinary, holistic approach that takes social, economic, and ecological factors into account. To ensure that development does not result in the depletion of resources, innovations must be adapted to local conditions. These methods greatly support the UN Sustainable Development Goals (SDGs), particularly those pertaining to climate action, life on land, clean water, and responsible consumption, by encouraging a synergy between conservation and development.

Keywords: Natural resource conservation, sustainable development, innovative approaches, precision agriculture.

Agroforestry for Climate Adaptation and Environmental Conservation

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ABSTRACT

Agroforestry provides a resilient land-use system that promotes environmental preservation and climate adaptation by purposefully integrating trees with crops and/or livestock on the same land unit. Agroforestry is a nature-based solution that improves ecological stability and farm productivity in the face of growing climate variability, decreasing soil fertility, and biodiversity loss. Agroforestry systems mitigate the negative effects of droughts and floods by improving soil health through the use of leaf litter and root biomass, improving water retention, reducing erosion, and regulating microclimates. Shallow-rooted crops can access the nutrients that deep-rooted trees obtain from deeper soil layers. Increased ecosystem services like pollination, carbon sequestration, and pest control are also supported by species diversity in agroforestry. Agroforestry is a sustainable way to boost income while repairing degraded lands in areas like Bihar, where smallholder farmers frequently deal with land pressure and climate change. Incorporating native and multipurpose tree species with seasonal crops promotes long-term environmental sustainability in addition to ensuring food and nutritional security. Successful agroforestry models, their ecological advantages, and the socioeconomic effects on farming communities are highlighted in this abstract. It highlights the necessity of institutional frameworks, training, and policies that support agroforestry at the local level. By providing incentives and raising awareness, agroforestry adoption among farmers can greatly improve rural livelihoods while also advancing national climate goals and biodiversity preservation.

Keywords: Agroforestry, climate adaptation, soil conservation, biodiversity, sustainable land use.

Gender-Inclusive Approaches to Agroforestry and Environmental Security**Muneshwar Prasad Mandal***Department of Plant Physiology and Biochemistry, BPSAC, Purnea, Bihar – 854302, India***ABSTRACT**

Gender plays a critical yet often under-recognized role in shaping the success of agroforestry systems and their contributions to environmental security. In many rural and forest-dependent communities, women are primary custodians of biodiversity, seed preservation, and non-timber forest products, yet they face systemic barriers to land ownership, credit access, training, and decision-making. This study examines gender-inclusive approaches to agroforestry as a pathway to enhance both livelihood resilience and ecosystem sustainability. Drawing upon recent case studies from South Asia and Sub-Saharan Africa, the analysis highlights how participatory planning, equitable resource distribution, and targeted capacity-building can significantly improve adoption rates and ecological outcomes. Integrating women into community forestry committees, farmer field schools, and climate-smart agroforestry initiatives not only increases productivity but also ensures long-term stewardship of soil, water, and forest resources. Furthermore, gender-responsive policies—such as joint land titling, microfinance tailored for women farmers, and market linkages for women-led agroforestry enterprises—emerge as critical enablers of environmental security. By aligning Sustainable Development Goals (SDGs) 5 (Gender Equality), 13 (Climate Action), and 15 (Life on Land), gender-inclusive agroforestry models offer a transformative approach to combating climate change, enhancing biodiversity, and ensuring equitable benefit-sharing. This paper argues that without dismantling gender-based barriers, agroforestry's full potential for climate resilience, carbon sequestration, and natural resource management will remain unrealized. Thus, mainstreaming gender equity into agroforestry policies and practices is not only a matter of social justice but a prerequisite for sustainable environmental security in the face of global climate challenges.

Keywords: Gender Equity, Agroforestry, Environmental Security, Climate Resilience, Sustainable Development Goals, Life Sciences, Biomedical Sciences, and Biotechnological Aspects.

Genetic Diversity and Population Structure of the Vulnerable *Schizothorax plagiostomus* in the Tons River, Uttarakhand, Based on Mitochondrial Cytochrome Oxidase I and Cytochrome b Analyses**Pooja Badoni¹, Archana Bahuguna² and JVS Rauthan³**

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ABSTRACT

Introduction: *Schizothorax plagiostomus* is a vulnerable, freshwater species native to Himalayan rivers, which is increasingly facing pressures from habitat loss or degradation, overfishing, species introduction, Pollution, hydrological alterations, and climate change.

Objectives: This study examines the genetic diversity and population structure of *Schizothorax Plagiostomus* populations inhabiting the Tons River, a tributary of the Yamuna in Uttarakhand, utilizing mitochondrial DNA markers and molecular analysis.

Methods: A total of 41 Cytochrome oxidase I (COI) sequences (450 bp) and 45 Cytochrome b sequences (312 bp) of *Schizothorax Plagiostomus* were taken from 4 different sites along the river, for analysis. Genetic diversity parameters, including haplotype diversity (Hd), nucleotide diversity (π), and polymorphic sites, along with the number of Haplotypes, were assessed.

Results: The Results revealed that COI has 10 haplotypes and 9 polymorphic sites, with an overall haplotype diversity of 0.673 ± 0.056 and nucleotide diversity of 0.00215 ± 0.0003 . Furthermore, Cytb analysis revealed 14 haplotypes, 20 polymorphic sites, an overall haplotype diversity of 0.700 ± 0.071 , and a nucleotide diversity of 0.00533 ± 0.00147 , indicating a moderate level of genetic diversity in COI and a comparatively higher level in Cytb. While analyzing concatenated sequences (COI + Cytb), 21 haplotypes were identified, with a haplotype diversity of 0.899 ± 0.035 and a nucleotide diversity of 0.00293 ± 0.00040 , indicating high genetic diversity. Haplotype network analysis revealed marked differences in haplotype distributions and frequencies among the four sampling sites. These observed unique haplotypes may be useful for differentiating the fish stocks.

Conclusions: These findings highlight the importance of conserving existing genetic variation in this species' populations and provide a scientific basis for assessing fisheries resources and managing the species diversity by ensuring habitat connectivity, minimizing anthropogenic pressures, and preventing genetic erosion.

Keywords: Genetic diversity, *Schizothorax plagiostomus*, Cytochrome oxidase I, Cyt b, Tons, Vulnerable.

Predicting wheat disease severity using real-time weather data and advanced machine learning models

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ABSTRACT

The integration of disease severity data with real-time meteorological variables and advanced machine learning (ML) techniques provides valuable predictive insights for managing wheat diseases. This study explores the application of ML models, particularly artificial neural networks (ANN), in forecasting the severity of *Puccinia striiformis* f. sp. *tritici* (yellow rust) and *Blumeria graminis* f. sp. *tritici* (powdery mildew) under varying sowing conditions. The Objectives of the current study was: to investigate weather-disease relationships for yellow rust and powdery mildew in wheat, to evaluate the predictive accuracy of ANN, Random Forest (RF), and regularized regression models and to identify key meteorological variables influencing disease progression.

A field experiment was conducted during two consecutive rabi seasons (2023 and 2024) using a randomized block design with four sowing dates. Weekly disease severity was recorded and combined with real-time meteorological data. ANN, RF, and regularized regression models (Elastic Net, Lasso, Ridge) were developed for prediction. Principal component analysis (PCA) was applied to identify critical weather predictors.

ANN achieved the highest predictive accuracy, with R^2 values of 0.96 (yellow rust) and 0.98 (powdery mildew) for calibration, and 0.93 and 0.95 for validation, respectively. RF also performed well (calibration $R^2 = 0.97$ and 0.98; validation $R^2 = 0.93$ and 0.90 for yellow rust and powdery mildew, respectively). Regularized regression models showed moderate accuracy. PCA revealed evapotranspiration, temperature, wind speed, and relative humidity as key drivers of disease incidence. ANN and RF models, integrated with high-resolution meteorological data, provide accurate early disease forecasts for wheat. This approach can form the basis of decision support systems to help farmers adopt timely, targeted disease management strategies, minimizing losses and supporting climate-resilient agriculture.

Keyword: Mildew, Machine Learning and ANN

In-Vitro Attempts in Various Toxic Concentrations of Cadmium in Pearl Millet (*Pennisetum typhoides* S. & H.)**Shivani Pawar¹, Shalabh Gupta² and Anil Kumar³**^{1,2}*Department of Botany, S.B.S. Govt. PG College, Rudrapur (U.S. Nagar) 263153, Kumaun University, Nainital, Uttarakhand (India).*³*Department of Botany S.D.M. Govt. PG College, Doiwala (Dehradun) 248140***ABSTRACT**

Heavy metals are of great interest for research purpose with respect to toxicological importance to human health, plants and animals. Due to rapid industrialization, urbanization and intensive agricultural practices increasing contamination of heavy metals in soil has become a major concern. In the present research work a millet crop *Pennisetum typhoides* has been selected and exposed to various heavy metal (Cd) treatments. The main attempt of the present work was to raise plants in high Cd concentrations so that they may be grown in Cd rich soils. The control and treated seedlings of three accessions of *Pennisetum typhoides* were subjected to dedifferentiation and redifferentiation attempts using combination of auxins and cytokinins with MS medium. Various seedling parts like hypocotyls and cotyledons, root or whole seedlings were taken from pre cultured condition. The callus induction was found on 6th day from the inoculation date. The callus was observed in all treatments except 10⁻¹M Cd concentration in all 3 accessions. The callus obtained from above experiments was further subjected to shoot and root induction experiments. For shoot induction two cytokinins were used in solid medium. Maximum shoots were observed in all concentrations except 10⁻¹M Cd in all accessions, for root formation two auxins were used in different concentrations. Maximum roots were observed in control and lower concentrations in all accessions. No root formation was observed in 10⁻¹M Cd. On the basis of results we can conclude that the high concentrations of Cd in crops retard plant growth, reduce crop production and even promote severe Cd contamination in agricultural products. The development and combination of these various *in-vitro* techniques will contribute the sustainable and safe propagation of Cd contaminated soil.

Keywords: dedifferentiation, redifferentiation, callus induction, solid medium, propagation.

Agroforestry to Architecture: Promoting Plantation-Sourced Low-Quality Poplar for Sustainable Support Structures**Sumanta Das¹, Manaswini Mahapatra² and Anil Kumar Sethy³**¹*Department of Forest Product & Utilisation, Faculty of Forestry, Birsa Agricultural University, Kanke, Ranchi, 834006, India*²*Faculty of Agriculture & Allied Sciences, CV Raman Global University, Bhubaneswar 752054, India*³*ICFRE-Institute of Wood Science and Technology, 18th Cross, Malleswaram, Bangalore 560003, India***ABSTRACT**

Agroforestry, along with green building technology, is evolving as a sustainable approach towards safeguarding the environment from the impact of rapidly increasing carbon emissions, climate change and shortage of resources. In India, poplar (*Populus* spp.) based agroforestry is widespread and has been widely accepted by farmers in North-Indian states like Punjab, Haryana, Western Uttar Pradesh, Uttarakhand and Himachal Pradesh due to their rapid growth and compatibility with industrial uses such as pulp and timber production. The incorporation of poplar trees into agroforestry systems fosters more effective land use and higher returns through better timing and arrangement of crops, enabling farmers to increase income while improving soil and biodiversity. Due to advances in technology, low-quality and underutilised fast-growing hardwoods from agricultural regions are now being used as green alternatives to steel and concrete in load-bearing structures, with a prime focus on poplar. Sustainable

timber management, effective resource management, and the transformation of low-quality timber into engineered high-performance construction materials using Cross-Laminated Timber (CLT), Glued Laminated Timber (GLT, Glulam), and Laminated Veneer Lumber (LVL) timber are discussed. This article provided a critical review of the integration of modern technologies into adhesive bonding systems and hybrid species arrangements to optimise mechanical strength, durability, and structural compliance. From an environmental perspective, poplar trees can minimise the carbon footprint of construction activities, simultaneously enhancing rural economies and aiding the conservation of natural resources. This research emphasises poplar's critical role in enhancing environmental resilience and shifting the paradigm of construction material sustainability by situating its cultivation into the context of agroforestry and the principles of the circular economy.

Keyword: Agroforestry, Cross-Laminated Timber (CLT), Glued Laminated Timber (GLT), Laminated Veneer Lumber (LVL), Poplar

Assessment of Wood Specific Gravity in the Moist Tropical Forests of Buxa Tiger Reserve, West Bengal, India

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ABSTRACT

The sustainable management of forest resources requires accurate knowledge of wood properties, such as specific gravity, which influences timber quality and ecological functions. However, baseline data on wood density for many tree species in the Buxa Tiger Reserve region remain limited. To address this gap, the present study was conducted to assess the specific gravity of 109 tree species in the West Rajabhatkhawa Range of Buxa Tiger Reserve, West Bengal, India, between 2019 and 2022. The study area is broadly classified as a moist tropical forest according to Champion and Seth (1968). Vegetation analysis was conducted using 140 nested quadrats of varying sizes with a sampling intensity of 0.1 % across 18 forest compartments covering 5,631 hectares. The wood samples of the recorded 109 tree species were collected from the main stem at breast height using a Pressler's increment borer. Specific gravity was calculated by the maximum moisture method, with green weight recorded in the field and oven-dry weight measured in the laboratory. The results showed that specific gravity ranged from a low of 0.25 ± 0.033 in *Tetrameles nudiflora* to a high of 0.87 ± 0.012 in *Terminalia chebula*, with medium values observed in *Ficus racemosa* (0.50 ± 0.050) and *Tectona grandis* (0.51 ± 0.017). Among the 109 species recorded, 13 exhibited low specific gravity (0.25–0.40), 76 species had medium specific gravity values (0.41–0.60), and the remaining 20 species showed high specific gravity values (0.61–0.87). These results reveal significant interspecific variability in wood density, emphasizing its critical role in influencing species-specific ecological functions and commercial potential. The generated baseline data provide a foundation for enhancing the precision of forest inventories, optimizing sustainable timber harvesting practices, and informing targeted conservation and management interventions within the reserve. Moreover, these findings can be utilized in biomass estimation, carbon stock assessments, wood quality evaluation, and ecological modelling, thereby supporting broader efforts in climate change mitigation and sustainable forest management. This study highlights the necessity of incorporating species-specific wood property metrics into forest resource assessments to improve management efficacy and ecological sustainability.

Keywords: Specific Gravity, Wood Density, Moist Tropical Forest, Buxa Tiger Reserve, Carbon Stock.

Sustainable Cotton Pest Management in the Era of Climate Change

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ABSTRACT

Climate change has intensified pest dynamics in cotton ecosystems, with rising temperatures and altered rainfall patterns contributing to increased survival and resurgence of key pests such as the pink bollworm (*Pectinophora gossypiella* Saunders). This pest continues to pose a significant threat to cotton production, leading to heavy crop losses and greater dependence on chemical pesticides-practices that further stress environmental systems. In this context, the present study evaluated the effectiveness of SPLAT (Specialized Pheromone and Lure Application Technology), a wax-based formulation containing the PBW sex pheromone gossypure, as a sustainable mating disruption tool under field conditions. Field demonstrations revealed marked improvements in plant health and pest suppression. The number of rosette flowers per plant—a key symptom of pink bollworm infestation—was significantly reduced in SPLAT-treated plots (1.3) compared to untreated controls (5.8). Larval infestation in 20 unopened bolls dropped from 8.3 (control) to 1.2 (SPLAT), and the number of bad opened bolls per plant declined from 11.5 to 2.5. These improvements contributed directly to better boll retention and fiber quality. Average yield in demonstration plots was 24.10 quintals per hectare, an 11.83 % increase over control plots (21.25 q/ha). Cultivation costs were also lower in SPLAT-treated plots (₹44,800) versus controls (₹60,200), while gross returns reached ₹175,930 compared to ₹155,125. This resulted in net returns of ₹131,130 (SPLAT) and ₹94,925 (control), with benefit-cost ratios (BCR) of 3.92 and 2.57, respectively. By reducing pest pressure without reliance on chemical pesticides, SPLAT not only enhances resilience in cotton production systems but also aligns with climate-smart agriculture goals. This technology offers a scalable, eco-friendly, and economically viable solution within integrated pest management (IPM) frameworks to support cotton sustainability in an era of increasing climate variability.

Keywords: *Bt* cotton, pink bollworm, climate change, mating disruption, SPLAT, eco-friendly, pest management, IPM.

Integrated Pest Management of *Helicoverpa armigera* Hubner in Chickpea: A Sustainable Approach in Climate Change era

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ABSTRACT

Helicoverpa armigera Hubner, commonly known as pod borer, is a major pest affecting chickpea production in India. An integrated pest management (IPM) strategy was implemented and demonstrated in Raichur district, Karnataka, to reduce pest incidence and improve crop productivity. The technology integrates multiple cultural, biological, and mechanical practices tailored for regional conditions. Key components include deep summer ploughing to expose and kill pupae, early and timely sowing to escape peak pest periods, and the use of sorghum or sunflower (100 g/acre each) as live bird perches to attract insectivorous birds. Nipping at 20 days after sowing promotes branching and enhances yield potential. Pheromone traps (@ 2/acre) and branched twig perches (@10/acre) support pest monitoring and natural predation. Use of neem-based ovicides, bio-control agents, and need-based application of chemical insecticides ensures eco-friendly and cost-effective pest suppression. Field-level demonstrations showed a significant reduction in pod borer damage and increased chickpea yield. Farmers reported

improved crop performance and reduced pesticide dependency. The strategy not only minimizes environmental impact but also reduces the cost of cultivation through targeted interventions. This integrated approach has proven effective and scalable, offering a sustainable model for managing *H. armigera* in chickpea-growing regions.

Keywords: Chickpea, *Helicoverpa armigera*, IPM, pheromone traps, bird perches

Precision Agriculture and soil water conservation innovations

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ABSTRACT

Precision agriculture comprises a set of technologies that combines sensors, information systems, enhanced machinery, and informed management systems to optimize production by accounting for variability and uncertainties within agricultural systems. Precision agriculture enables the monitoring of the food production chain and the management of both the quantity and quality of agricultural produce. Applications of technologies and principles to manage spatial and temporal variability associated with all aspects of agricultural production to improve crop performance and environmental quality. Success in precision agriculture is related to how well it can be applied to assess, manage, and evaluate the space-time continuum in crop produce. The agronomic feasibility of precision agriculture has been intuitive, depending largely on the application of traditional management recommendations at finer scales, although new approaches are appearing. The agronomic success of precision agriculture has been limited and inconsistent, although quite convincing in some cases, such as nitrogen (N) management in sugar beet (*Beta vulgaris* spp.). Management parameters with high spatial dependence and low temporal variance (e.g., liming, P, and K) will be more easily managed precisely than those with large temporal variance (e.g., mobile insects). The potential for economic, environmental, and social benefits of precision agriculture is complex and largely unrealised because the space-time continuum of crop production has not been adequately addressed.

Precision agriculture and innovations in soil and water conservation are revolutionizing modern farming by enhancing productivity with environmental sustainability. With usage of technologies such as GPS mapping, remote sensing, and data analytics, farmers can optimize input use, reduce waste, and better manage natural resources. Innovations like drip irrigation, cover cropping, and soil sensors further support long-term soil health and water efficiency. Together, these approaches not only increase agricultural resilience to climate change but also promote a more sustainable and resource-conscious future for global food systems. Soil water conservation is therefore very important to build a resilient, sustainable agricultural system as climate and water issues intensify. Success stories range from India to Kenya and show the dramatic potential in the mitigation of drought impacts and improvement in soil health. Scaling them up, however, calls for collaboration among policymakers, researchers, and communities. Prioritizing soil water conservation means paving the way for a future in which agriculture is productive, ecosystems are protected, and water resources are managed responsibly.

Keywords: Agriculture, soil water and conservation

Optimization of Iron Nanoparticle Concentrations for Enhanced Mycelial Growth of *Lentinula edodes*

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ABSTRACT

Lentinula edodes (Shiitake) is one of the economically important mushroom known widely for its nutritional and pharmaceutical benefits. Enhancing the production of this mushroom through nanotechnological interventions can be beneficial for the mushroom cultivators. Therefore, this study is being carried out to evaluate the optimal concentration of iron (Fe) nanoparticles for promoting mycelial growth of *Lentinula edodes* on Liquid and solid media. Different concentrations of Fe nanoparticles were tested, and their effects on mycelial growth rate and biomass accumulation were assessed. In solid media, radial growth and colony morphology were monitored on different days. Preliminary results suggest that specific concentrations of Fe nanoparticles significantly enhance mycelial growth, while higher concentrations exhibit inhibitory effects, indicating a dose-dependent response.

Keywords: Iron Nanoparticles, *Lentinula edodes*, Mycelial Growth, Solid Media and Liquid Media.

Integrative Molecular and Metabolomic Characterization of *Momordica dioica* Roxb. for Anticancer Drug Discovery

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ABSTRACT

Momordica dioica Roxb., a dioecious climber native to the Indian subcontinent, is traditionally recognized for its culinary value and therapeutic properties, but remains understudied at the biochemical and molecular levels. In this study, we present a multi-omics exploration—encompassing phenomics, metabolomics, and genotyping—across distinct developmental stages and landraces of *Momordica dioica* to uncover regulatory networks and metabolic signatures with potential anticancer relevance. Integrative analyses revealed stage-specific and genotype-dependent expression of key regulators associated with secondary metabolite biosynthesis, stress responses, and cellular homeostasis. Metabolite profiling identified a diverse range of bioactive compounds, including cucurbitacin, saponins, flavonoids, and phytosterols, some of which demonstrate strong in-silico binding affinities to human cancer targets such as Hippo pathway expressor protein (HPEP) and HSP-70. Landrace-specific molecular markers revealed hidden diversity and possible adaptive divergence linked to ecological niches. This study provides foundational insights into the molecular landscape of *Momordica dioica*, offering a blueprint for its rational utilization in bioprospecting and plant-based therapeutic development. Our findings also position *Momordica dioica* as a promising candidate for domestication and targeted breeding to enhance metabolite yield and pharmaceutical relevance.

Keywords: Secondary metabolites; Molecular docking; Triple negative breast cancer; Heat shock protein 70; Beta-sitosterol; Isopulegol

**Climate Change- Challenges and Mitigation
Dharam Pal***Anskriti University, Chhata, Mathura (U.P)***ABSTRACT****Introduction**

Climate change is no longer a distant threat—it is a present-day reality. Defined as long-term alterations in temperature, precipitation, wind patterns, and other elements of the Earth's climate system, climate change has become one of the most urgent and complex challenges facing humanity. It is primarily driven by the increase in greenhouse gases (GHGs) due to human activities, particularly carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O) emissions.

Scientific evidence confirms that global temperatures are rising at an alarming rate. According to the Intergovernmental Panel on Climate Change (IPCC), the Earth has already warmed by approximately 1.1°C above pre-industrial levels, and the consequences of even this modest increase are profound. Understanding the challenges posed by climate change and identifying effective mitigation strategies is critical for securing a sustainable future.

I. Causes of Climate Change**1. Greenhouse Gas Emissions**

The primary cause of recent climate change is the accumulation of GHGs in the atmosphere:

Burning of fossil fuels (coal, oil, and natural gas) for electricity, transport, and industry.

Deforestation, which reduces carbon absorption and adds CO₂ to the atmosphere.

Agricultural practices, especially livestock farming, contribute significant methane emissions.

Industrial processes release various gases, including fluorinated gases with high global warming potential.

2. Land Use Changes

Urbanization, deforestation, and conversion of forests to farmland alter natural carbon sinks and increase surface albedo, contributing to global warming.

II. Challenges Posed by Climate Change

Climate change creates wide-ranging challenges that affect every region of the world, though their severity varies based on geography, development, and resilience capacities.

1. Environmental Challenges

Rising temperatures are leading to the melting of glaciers and polar ice caps, resulting in sea-level rise. Ocean acidification is damaging coral reefs and marine ecosystems.

More frequent and intense natural disasters—heatwaves, hurricanes, floods, and droughts—are becoming common.

Biodiversity loss as many species cannot adapt quickly to the changing environment.

2. Economic Challenges

Damage to infrastructure from extreme weather events increases repair and reconstruction costs.

Reduced agricultural productivity, threatening food security and rural livelihoods.

Strain on water resources due to erratic rainfall patterns and droughts.

Disruption of global supply chains, tourism, and insurance industries due to climate volatility.

3. Social and Health Challenges

Climate-induced migration creates pressure on urban areas and increases risks of conflict.

Public health issues arise from heat stress, respiratory problems, waterborne diseases, and vector-borne illnesses like malaria and dengue.

Inequity and injustice, as marginalized communities often suffer the most but contribute the least to emissions.

III. Mitigation Strategies for Climate Change

Mitigation refers to efforts to reduce or prevent the emission of GHGs and enhance carbon sinks. A combination of technological innovation, policy measures, lifestyle changes, and global cooperation is essential.

1. Transition to Renewable Energy

Solar, wind, hydro, and geothermal energy can replace fossil fuels in power generation.
Decentralized energy systems like rooftop solar panels promote energy access in rural areas.
Battery storage and smart grids enhance reliability and efficiency.

2. Energy Efficiency

Building insulation, energy-efficient appliances, and industrial optimization reduce consumption.
Green architecture and urban planning can lower energy use and carbon footprint.

3. Sustainable Transportation

Promoting electric vehicles (EVs) and expanding public transport networks.
Encouraging non-motorized transport such as cycling and walking.
Adoption of biofuels and hydrogen fuels as cleaner alternatives.

4. Nature-Based Solutions

Afforestation and reforestation to absorb CO₂.
Wetland and mangrove restoration to act as carbon sinks and buffers against storms.
Agroforestry and regenerative agriculture to improve soil carbon storage.

5. Carbon Capture and Storage (CCS)

Technologies that capture CO₂ emissions from industrial sources and store them underground can help reduce atmospheric GHG levels, though scalability and cost remain concerns.

6. Sustainable Agriculture

Precision farming, drip irrigation, and organic methods reduce emissions and enhance resilience.
Climate-resilient crops and diversified farming reduce vulnerability to extreme weather.

7. Circular Economy

Reducing waste, recycling materials, and designing products for longevity minimize emissions from production and landfills.

IV. International and National Mitigation Efforts

1. Global Agreements

Paris Agreement (2015): A landmark treaty where countries committed to limiting global warming to well below 2°C, with efforts to limit it to 1.5°C.
Kyoto Protocol: An earlier agreement targeting emissions reductions in industrialized nations.
COP Conferences: Annual summits under the UNFCCC to review progress and enhance commitments.

2. Climate Finance and Technology Transfer

Developed countries pledged to provide \$100 billion annually to help developing nations adapt to and mitigate climate change.
Promotion of green technologies, early-warning systems, and resilient infrastructure in low-income nations.

3. Nationally Determined Contributions (NDCs)

Each country outlines its plans and targets for emissions reduction, often including renewable energy adoption, forest conservation, and industrial regulation.

V. The Role of Individuals and Communities

While policy and technology are critical, individual and community actions are equally important:
Reducing energy use, conserving water, and minimizing food waste.
Using public transport, cycling, or carpooling.
Supporting sustainable products and businesses with low environmental impact.
Environmental education to increase awareness and behavioral change.

Conclusion

Climate change is a multifaceted crisis that threatens the foundations of human civilization and the planet's ecological balance. However, it is also a powerful catalyst for global transformation. The challenges it poses are formidable, but not insurmountable. Through decisive action, innovative technologies, strong policy frameworks, and a collective commitment to sustainability, the worst impacts of climate change can still be avoided.

Mitigation must be pursued in tandem with adaptation strategies to protect vulnerable communities and ecosystems. The window for effective action is rapidly closing, but with a shared vision and sustained effort, a resilient and low-carbon future remains within reach.

Soil Carbon Sequestration Potential in Rainfed Area

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ABSTRACT

Agriculture in rainfed areas is the backbone of food production for millions of small and marginal farmers worldwide. India is still a predominantly agrarian economy. Of the total geographical area of 328.7 million ha (Mha), 141 Mha is the net cultivated area devoted to agriculture, of which only 63 Mha or 44% is the net irrigated area producing more than 56% of the total food grains (FAI, 2011). However, these regions face serious challenges — unpredictable rainfall, declining soil fertility, low crop yields, and vulnerability to climate change. Rainfed areas possess substantial capacity to increase soil organic carbon stocks. However, factors such as low and erratic rainfall, soil erosion, limited resource availability, and socio-economic constraints pose significant barriers to realizing this potential (Sharma and Arora, 2015). Innovative, climate-smart practices tailored to local conditions can enhance soil structure, water-holding capacity, and nutrient availability, thereby improving crop resilience and farmer incomes. One promising and sustainable way to address these issues is by increasing soil carbon sequestration, which is the process of capturing atmospheric carbon and storing it as organic matter in the soil. Carbon sequestration is the process by which atmospheric carbon dioxide (CO₂) is captured and securely stored in terrestrial, geological, or oceanic reservoirs for long periods of time. Increasing SOC stocks in agricultural soils is conducive to the productivity and sustainability of agroecosystems (Chenu et al. 2019). Strategies that increase organic inputs (e.g., application of organic amendments, cover crops and crop rotations) while decreasing soil respiration by minimizing soil disturbances (e.g., conservation tillage) are suggested to increase SOC sequestration in agroecosystems (Zhao et al., 2018). Therefore, integrated management practices should be designed to accelerate SOC sequestration in croplands. Integrating these practices into rainfed agricultural systems not only improves soil fertility but also contributes to long-term carbon storage, mitigating greenhouse gas emissions and supporting global climate goals. In rainfed areas, soil carbon sequestration is a powerful way to improve soil health, increase agricultural productivity, and enhance resilience to climate change. By adopting sustainable practices like conservation tillage, crop rotations, and organic amendments, farmers can boost soil carbon levels, support food security, and contribute to a healthier environment. Investing in soil carbon sequestration is a practical step toward sustainable rainfed agriculture and long-term climate benefits.

Keywords: Rainfed agriculture, carbon sequestration, soil organic matter, soil fertility

Modern Farming and the Decline of Food Quality: A Call for Organic Revival for Health and Sustainability with Special Reference to Haryana**Subham***Department of Geography, Shri Jagdishprasad Jhabarmal Tibrewala University, Jhunjhunu, Rajasthan*
ABSTRACT

Modern agricultural practices have led to a substantial rise in crop yields and food production, especially in states like Haryana, which played a key role in India's Green Revolution. However, this success has come at the cost of deteriorating food quality, environmental degradation, and increased health risks. Excessive use of chemical fertilizers, pesticides, and genetically modified crops has compromised the nutritional content of food and contributed to various chronic health problems in rural and urban populations. Haryana's intensively farmed districts are witnessing soil fatigue, water contamination, and pesticide-related illnesses. In contrast, organic farming offers a sustainable and health-oriented alternative. By using natural methods and inputs, organic agriculture restores soil health, improves food quality, and minimizes harmful residues in the food chain. This paper explores the contrasting impacts of modern and organic agriculture in Haryana, evaluates health and environmental outcomes, and recommends policy-driven solutions for transitioning towards organic farming to ensure long-term agricultural sustainability and public well-being.

Keywords: Organic farming, modern agriculture, food quality, Haryana, health impacts, soil degradation, sustainability, pesticides, nutrition

Bioremediation-Driven Green Nanotechnology for Sustainable Textile Innovation**Vaishali and Nisha Arya***Department of Apparel and Textiles Science, I.C. College of Community Science CCS Haryana Agricultural University, Hisar-125004, India***ABSTRACT**

The textile industry is one of the largest industrial sectors contributing to environmental degradation, producing massive amounts of wastewater, dyes, finishing chemicals, and solid waste. These pollutants, rich in toxic heavy metals, synthetic dyes, and microfibers, not only disrupt aquatic ecosystems but also pose long-term risks to soil fertility, biodiversity, and human health. Traditional physical and chemical treatment methods, while effective in the short term, are often energy-intensive, costly, and generate secondary waste. In contrast, bioremediation has emerged as an eco-friendly and cost-effective alternative that utilizes the metabolic potential of microorganisms, algae, fungi, and plants to degrade, detoxify, or immobilize pollutants. Bioremediation strategies are broadly classified into in situ and ex situ approaches. In situ methods treat contaminants directly at the site through techniques like bioventing, phytoremediation, and natural attenuation, minimizing disturbance to the environment. Ex situ methods, such as bioreactors, composting, and engineered wetlands, involve the removal of contaminated material for treatment under controlled conditions, allowing for greater efficiency and process optimization. Recent innovations combine bioremediation principles with green nanotechnology to address both textile waste management and the creation of sustainable value-added products. Plant-based bioreduction processes can be used to synthesize nanoparticles, eliminating the need for hazardous chemicals while reducing carbon emissions. These bio-nanoparticles, when applied to textiles, can impart functional properties such as antimicrobial activity, self-cleaning ability, UV protection, and even wound-healing potential, contributing to the concept of “smart” and “green” textiles. By transforming waste into functional materials, this integrated approach supports the circular economy, reduces environmental footprint, and enhances the sustainability of textile manufacturing. The synergy between bioremediation technologies and textile innovation offers a promising pathway

toward cleaner production, resource conservation, and climate-resilient material systems, aligning with global goals for sustainable development and environmental restoration.

Keywords: Bioremediation, textile waste management, green nanotechnology, circular economy

Haryanvi Women's Folk Songs and Nature

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ABSTRACT

Women in Indian Philosophy are symbolized as '*Prakriti*' which means nature. They have been nurturing the earth and caring for the environment as a result of their closeness to nature. Traditionally, women have been responsible for the mobilization and management of resources. Throughout the history of human civilization, they have been contributing to the conservation of nature and are known as the custodians of it.

Women play the role of custodian of the nature in many ways. Since they have a deep sense of belongingness to the folk songs, customs, rituals, their role as a protector of nature becomes significant. They protect the nature through their activities like protecting the ecosystem by worshipping the trees, rivers, sun, moon, earth etc. as is evident from many studies all over the world. Inclusion of nature in folk songs sung particularly by women form an important part of protecting nature by them. There are various folk songs in which various forms of nature and their protection measures are mentioned. Such songs reflect a deep association, strong bonding and interconnectedness between women and nature. In this paper, an attempt has been made to examine the role of women in protecting the nature through folk songs and *Ragini* (a type of folk song) in Haryana. The study is based on primary data collected from the selected villages of Haryana by conducting interviews and making observations by meeting individual women. This study also emphasizes the need to preserve and promote the folk songs in order to conserve the nature.

Keywords: Eco-feminism, Culture, Nature, Folk Songs

Potential Ecosystem services from agroforestry land use of North Western Himalaya, India

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ABSTRACT

The present study was conducted with the aim, to assess the Plant diversity under prominent Agroforestry systems, to analyse the soil properties and assess the carbon stock potential of various agroforestry systems, and to quantify the ecosystem services from Agroforestry systems from Central Kashmir in India. Quadrature method was employed by using quadrates of 10m × 10m for trees with two sub- quadrates of 5m × 5m for shrubs and four 1m × 1m quadrates for herbaceous flora/agricultural crops/grass species were laid out in each system for further assessment. The results demonstrated that there are seven agroforestry systems in the study area viz., Agri-horti-silvi-pastoral system, Hortisilvicultural system, Boundary Plantation, Hortisilvipastoral system, Agri-horti-silvicultural system, Hortipastoral system, Silvipastoral system. A total of 39 plant species from 15 families and 29 genera were documented including 14 tree species, 17 agricultural crops species and 8 grass species. It is found that the structural characteristics and floristic composition vary according to the system arrangement and the management system. On an average, the maximum carbon stock was recorded from Agri-horti-silvi-pastoral system ($133.25 \pm 3.04 \text{ t ha}^{-1}$) followed by Agri-horti-silvicultural system ($113.56 \pm 2.60 \text{ t ha}^{-1}$) and the minimum was recorded from Hortipastoral system ($45.98 \pm 4.82 \text{ t ha}^{-1}$). Tree wise carbon stock was recorded maximum for *Populus deltoids* (14.25 t ha^{-1}) followed by *Populus*

nigra (13.6 t ha⁻¹) and *Salix alba* (12.9 t ha⁻¹). The soil from the studied system in general are slightly acidic to neutral in reaction with a pH range of 6.68 - 6.90. The overall mean Bulk density values ranged from 0.94 g cm⁻³ to 1.18 g cm⁻³. The soil were generally high in organic carbon (1.09 % to 2.21 %), soil carbon stock (20.67 t ha⁻¹ to 38.60 t ha⁻¹), medium in soil microbial biomass carbon (345 µg g⁻¹ to 565 µg g⁻¹). The available nitrogen content ranged between 303.61 kg ha⁻¹ to 339.67 kg ha⁻¹. Agri-horti-silvipastoral system (339.67 kg ha⁻¹) recorded highest and the lowest was for Boundary plantation (303.61 kg ha⁻¹). Available phosphorus content ranged between 17.13 kg ha⁻¹ to 41.20 kg ha⁻¹ and the available potassium content ranged between 243.87 kg ha⁻¹ to 297.29 kg ha⁻¹. Total economic value in terms of marketable and non-marketable services were Rs 121800 ha/yr for sole agricultural field and Rs 507253.75 ha/yr for agroforestry systems on an average basis. Economic benefit from soil fertility improvement and Carbon Sequestration on an average was Rs 3335.12 ha/yr and Rs 4492.90 ha/yr respectively. Agroforestry systems (AFS), which mimic natural forests, are increasingly recognized for their potential in sustainable land management and role is critical due to their significant species diversity, provision of essential ecosystem services, and carbon sequestration. These systems, particularly when incorporating species with high carbon sequestration potential, contribute to addressing global climate change. Studies highlight the multifaceted benefits of AFS, emphasizing their importance in sustainable development and environmental conservation efforts. These results demonstrate the importance of conserving and promoting the agroforestry systems (AFS), analogous to forests, due to the diversity of species, ecosystem services, and the total carbon they contain. These systems are gradually becoming important management systems, especially if they are associated with potential species to sequester carbon, such as those documented in this and several other studies that seek solutions to global climate change. The study above highlights the potential role of agroforestry systems in terms of ecosystem services to gain from global carbon market for livelihood development.

Keywords: Diversity, biomass, carbon stock, soil properties, ecosystem services

Productivity, quality and Growth of colored capsicum (*Capsicum annuum* L.) as influenced by cultivars and plant growth regulators under controlled environment conditions

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ABSTRACT

With rapid urbanisation and changing dietary habits in developing countries like India, the demand for nutritionally rich vegetables is on the rise. Coloured bell pepper (*Capsicum annuum*), known for its high nutritional value and market demand, plays an important role in promoting nutritional security. Enhancing its quality and productivity through exogenous application of plant growth regulators (PGRs) presents a promising approach. A study was conducted at the Department of Botany, Sanskriti University, Mathura, to investigate the effect of foliar application of PGRs on the seed yield and quality of two coloured capsicum cultivars: California Wonder (yellow) and Bombay (red). The experiment was laid out in a factorial randomized block design with four treatments: 4-CPA @ 50 ppm, GA₃ @ 35 ppm, Combination of 4-CPA + GA₃ (at highest concentrations), Control (tap water). Foliar sprays were applied at 30, 60, and 90 days after transplanting (DAT). Observations were recorded for various growth parameters, flowering, fruit set, yield components, and quality attributes. The interaction between California wonder cultivars and spraying with GA₃ at 35 or 50 ppm increased the number of flowers/plants in both seasons. On the other hand, the interaction between Bomay cultivar and spraying with tap water (control) gave the lowest values of the number of flowers/ plants, the number of fruits/ plant and fruit set (%), yield, and its components, and fruit quality in both seasons.

Keywords: Colored capsicum, Growth, 4-CPA, Plant growth regulators, Quality, Yield.

Micronutrient Promotes Yield and Yield Attributing Characters of Tomato Varieties**Bimala Kumari Sah¹, Anshu Kunwar¹, Gautam Jha¹, Bibhor Jayswal¹ and Abhisek Shrestha¹**¹*College of Natural Resource Management, Bardibas, Nepal*²*Agriculture and Forestry University, Rampur, Nepal***ABSTRACT**

Tomato (*Solanum lycopersicum* L.) is commercially one of the important vegetable crops valued for its nutritional and economic significance in Nepal. Micronutrients have very important role in growth parameters, yield attributes and fruit quality. Thus an study was conducted to evaluate the effect of foliar application of ferrous sulfate (FeSO₄) at different concentration as 1%-t1, 0.5%-t2 and control-t3 on different tomato varieties (Srijana-v1, Suman-v2 and Purbely Cheury tomato-v3) with the objective of assessing its role in improving plant growth, yield attributes, and fruit quality. The experiment was laid in Randomized Complete Block Design with three replications. The data was collected and entered in MS excel and analyzed by GenStat ver. 2018. All the germination parameter was collected, and mean separation was done by DMRT at 5% level of significance.

The result revealed that there was significant variation in yield where Srijana outperformed other varieties when treated with 0.5% FeSO₄ (42.8 ton/ha). The results showed that height is also varied along variety Srijana (130cm) and PCT (105.6cm) and also interaction v1t2(140.5cm) and v1t1(100.7cm). The variety Srijna also showed earlier flowering time and higher chlorophyll content was moderately varied along other varieties Srijna (57.99 SPAD) and Suman (51.08SPAD). Based on the findings Srijna treated with foliar application of 0.5% FeSO₄ performed well on most of the studied parameters.

Keywords: Tomato; Variety; FeSO₄; Yield; Yield attributes.

Precision Agriculture and Soil /Water Conservation Innovations**Renuka Bhakher* and Arvind Verma***Rajasthan College of Agriculture, MPUAT, Udaipur, Rajasthan***ABSTRACT**

Precision agriculture is revolutionising resource-limited and water-scarce regions through innovative soil and water conservation practices that improve sustainability and productivity. Advanced soil moisture monitoring tools including on-the-go sensors, UAVs, satellite imagery, IoT devices, and wireless sensor networks enable real-time, high-resolution data for precise irrigation decisions. Techniques such as alternate wetting and drying (AWD) in rice cultivation can conserve up to 38 % of water, reduce methane emissions, and maintain yield stability, though they may cause N₂O emissions and weed issues if poorly managed. Emerging solutions further strengthen conservation efforts. Hydrogel amendments significantly enhance water retention (up to 85 % in sandy soils), reducing erosion and drought stress. Nanotechnology enables real-time nutrient, pH, and contaminant monitoring through nano sensors, optimising irrigation and fertilisation. Robotic platforms, such as UGV-based systems, provide accurate field measurements, while AI-driven and remote sensing tools deliver data-based irrigation and nutrient plans. Traditional soil and water management relies on coarse, manual observations, often leading to over-irrigation, nutrient leaching, and soil degradation. Precision monitoring using IoT and remote sensing can optimise inputs and minimise losses. AWD adoption challenges can be addressed through farmer training and emission-monitoring tools. Low soil water retention, common in degraded soils, can be improved using hydrogels or nanocomposite amendments. Finally, the labour-intensive and fragmented nature of data collection can be resolved through robotics, AI-based decision-support, and integrated IoT networks, enabling timely and efficient resource allocation.

Keywords: Precision Agriculture, Soil and Water Conservation, Hydrogel.

Evaluating the Synergistic Effects of Diamide insecticides and Entomopathogens on Detoxification enzymes in *Spodoptera litura* (Fabricius)**Neeli Priyanka^{1*}, P. Duraimurugan², Neetu Roy² and Thamidela Meera Devi³**¹*Department of Entomology, College of Agriculture, PJTAU, Rajendranagar, Hyderabad (500030)*²*Crop Protection Section, ICAR- Indian Institute of Oilseeds Research, Hyderabad (500030)*³*Department of Entomology, S.V. Agricultural college, Tirupati, ANGRAU, A. P. (517502)***ABSTRACT**

The escalating resistance of *Spodoptera litura* to conventional insecticides necessitates the adoption of integrated pest management strategies that combine chemical and biological approaches. This study investigates the effects of diamide insecticides (chlorantraniliprole and flubendiamide) and entomopathogenic organisms (*Bacillus thuringiensis* and *Metarhizium rileyi*) both individually and in combination, on the activity of key detoxifying enzymes carboxylesterase (CarE), mixed function oxidases (MFO) and glutathione S-transferase (GST) in third instar larvae of *Spodoptera litura*. Insecticides applied alone have resulted in an upregulation of detoxifying enzymes, indicating an adaptive metabolic response. Conversely, treatments with microbial agents alone led to moderate enzymatic suppression. Combined applications, particularly simultaneous treatments of insecticides with entomopathogens, exhibited greater inhibitory effects on enzyme activity compared to individual treatments. Notably, sequential applications where microbial agents were introduced prior to insecticides resulted in the most substantial suppression of detoxifying enzymes, suggesting a synergistic interaction that disrupts the insect's detoxification pathways more effectively. These findings highlight the potential of integrating microbial biocontrol agents with selective insecticides to enhance pest suppression while mitigating resistance development. Such integrated approaches offer promising avenues for sustainable and effective management of lepidopteran pests.

Keywords: *Spodoptera litura*; Resistance; Carboxylesterase; Mixed function oxidases; Glutathione S-transferase; Integrated pest management

Global temperature rise and climate projections**Jigyasa Ninama¹ and Raghuveer Meena²***Swami Keshwanand Rajasthan Agricultural University, Bikaner Rajasthan***ABSTRACT**

Global temperature rise and changing climate patterns are profoundly affecting agriculture and agronomy worldwide. As temperature increases and weather becomes more unpredictable, crops face challenges such as heat stress, altered rainfall patterns, droughts, and floods, all of which impact growth, yield, and food security. Climate projections, developed through advanced modeling techniques, provide critical forecasts of future temperature trends, precipitation changes, and extreme weather events. These projections are essential tools for agricultural scientists, policymakers, and farmers to anticipate and manage the impacts of climate change. In agronomy, climate projections help optimize crop selection, planting schedules, irrigation practices, and pest and disease management, enabling farmers to adapt to new environmental conditions. By analyzing projected climate data, agronomists can develop strategies such as cultivating heat-tolerant and drought-resistant crop varieties, adjusting nutrient management, and improving soil and water conservation techniques. These adaptive approaches contribute to sustainable farming systems that maintain productivity under changing climates. The integration of global temperature trends and climate projections into agricultural planning supports resilience, efficiency, and sustainability. It empowers stakeholders to make informed decisions, reduce risks, and enhance food production despite climate uncertainties. Overall, climate-informed agronomy is key to ensuring long-term agricultural sustainability and food security in a warming world.

Keywords: Global temperature rise, climate projections, agriculture, agronomy, crop adaptation, climate resilience, sustainable farming, food security, climate change impacts, precision agriculture.

Comparative Study of Antimicrobial Activities of *Ocimum* Sps. Against Pathogenic Microorganism**Uma Sharma and Neha Pathak***College of Biotechnology, DUVASU, Mathura, 281003***ABSTRACT**

The family Lamiaceae has several significant decorative, therapeutic, and aromatic plants, many of which generate essential oils that are utilised in both conventional and contemporary medicine as well as in the food, cosmetics, and pharmaceutical industries. World-wide distribution of many plants from the genera *Hyssopus*, *Leonurus*, *Mentha*, *Nepeta*, *Origanum*, *Leucas*, *Salvia*, and *Ziziphora*, which are frequently used to heal wounds, gastritis, infections, dermatitis, bronchitis, and inflammation. Studying the antibacterial properties of herbal remedies appears relevant given the rise in their use in recent years. *Ocimum sanctum* and *Ocimum basilicum*, two varieties of the basil herb that are widely available for cultivation, may be a strong contender for usage as a plant with antibacterial properties. *Citrobacter freundii*, a gram-negative bacteria, and *Micrococcus luteus*, a gram-positive bacteria, were used to test the antibacterial effects of ethanolic leaf and stem extracts from *Ocimum sanctum* and *Ocimum basilicum*. By using agar disc diffusion tests maximum inhibition zones against the pathogenic bacteria *Citrobacter freundii* (20mm & 12mm) and *Micrococcus luteus* (9mm & 8mm) were seen in ethanolic leaf & stem extracts of *Ocimum sanctum*. *Ocimum sanctum* & *Ocimum basilicum* may be suggested as an easily accessible and renewable source of antibacterial agent rather than manufactured chemicals. The antimicrobial efficiency of *Ocimum sanctum* leaves & stem reveals that the plant exhibits significant antimicrobial capabilities.

Keywords: Lamiaceae, Medicinal plants, *Ocimum sanctum*, *Ocimum basilicum*, Ethanolic leaf & stem extracts.

Exploring the Effects of Shade Variability on Phytochemical Composition of *Bergenia ciliata* L. Rhizome in Kashmir Himalayas**Sabira Nissar, Tahir Mushtaq, P. A. Sofi, Amarjeet Singh, A. R. Malik¹, Peerzada Ishtiyak Ahmad and M. Iqbal Jeelani***Division of Forest Products and Utilization, Faculty of Forestry, SKUAST-Kashmir***ABSTRACT**

Bergenia ciliata, a perennial herbaceous plant native to the Himalayan region, has gained attention for its ornamental and medicinal properties. This study investigates the influence of varying shade levels i.e., SD1, SD2, SD3 and SD4 (0%, 25%, 50% and 75% respectively) on phytochemicals of *Bergenia ciliata*. The results revealed that shade percentage has significant effect on presence of phytochemicals. Phytochemical analysis revealed that alkaloids were absent and flavonoids and saponins were present in the rhizomes of *Bergenia ciliata*. The GC-MS Chromatogram of methanolic extract of rhizome of *Bergenia ciliata* planted under 25%, 50% and 75% shade revealed 27 peaks indicating the presence of large number of chemical compounds, bergenin being the most common. While as, the GC-MS Chromatogram of methanolic extract of rhizome of *Bergenia ciliate* planted under control condition (0%) exhibited 18 peaks. This study underscores the importance of managing shade levels and spacing for maintaining the presence of phytochemicals in the plant. It contributes to our understanding of how environmental factors influence the growth and bioactive compounds of *Bergenia ciliata*, ultimately aiding in its sustainable cultivation and conservation efforts.

Keywords: Himalaya, Conservation, Medicinal, Phytochemicals, Shade

Environmental Justice in India: A Review of Historical and Contemporary Discourse**Ritam Dhar¹, Samarpan Chakraborty^{1b}, Tamalika Mondal² and Debabrata Basu³**^{1a,b}(TDC-NICRA), Dhaanyaganga Krishi Vigyan Kendra, Ramakrishna Mission Vivekananda Educational and Research Institute, Murshidabad, West Bengal.²Sericultural Extension Economics and Management Division, Central Sericultural Research and Training Institute, Berhampore, Murshidabad, West Bengal.³Uttar Banga Krishi Viswavidyalaya, Pundibari, Coochbehar, West Bengal.**ABSTRACT**

Environmental Justice's discourse is deeply rooted in the nation's broader struggles for social and economic equity. In the decades following independence, state-led development initiatives such as large dams, mining projects and industrial plantations often resulted in the dispossession of rural populations, particularly tribal and other marginalized communities. This paper examines the historical foundations and evolving contemporary discourse on environmental justice, with particular attention to its articulation within India's socio-political arenas. This study draws on peer-reviewed research and a wide range of scholarly literature to provide an inclusive and multidimensional academic perspective. The review finds that environmental justice in India has grown from localized struggles for social and economic equity into a broad, multi-dimensional movement. Early campaigns such as the Chipko movement and the 'Narmada Bachao Andolan' connected environmental protection with community rights, prompting significant policy outcomes like the Forest Conservation Act (1980). The 1984 Bhopal gas disaster widened the focus to industrial hazards, spurring legal reforms and active judicial intervention through principles such as "polluter pays" and public trust. Today, Indian environmental justice blends global ideas with indigenous traditions, confronting issues of climate change, urban pollution, displacement, caste and gender inequality. With more than 60 million people displaced by development since independence, grassroots activism and legal advocacy remain central. The trajectory reflects a distinctive synthesis of local justice traditions and international frameworks, shaping contemporary environmental governance and socio-political discourse in the country.

Keywords: Environmental Justice, Social Movements, Forest Conservation Act, Climate Change, Indigenous Communities and Global-Local Nexus.

Seed Biopriming with *Trichoderma virens* and Jasmonic acid as a Green Strategy to Enhance Biochemical Defences in Tomato-stressed with fusarium wilt and damping off diseases**Monika Sood**

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Introduction

Seed biopriming with a biocontrol agent and an inducer is a sustainable, eco-innovative technology for mitigating multiple plant stresses. This approach reduces dependency on agrochemicals, conserves soil health, and supports resilient cropping systems in line with environment-friendly crop production.

Methods

The study evaluated the effects of *Trichoderma virens* (Tv) and jasmonic acid (JA) on secondary metabolites and pigment profiles in tomato plants challenged with *Fusarium oxysporum* f. sp. *lycopersici* (Fol) and *Rhizoctonia solani* (Rs). Tomato seeds were primed with *Trichoderma virens* (Tv) (1×10^7 spores/mL) and/or Jasmonic acid (JA) (1 μ M) and germinated for 30 days under controlled conditions. Seedlings were then inoculated with Fol (1×10^6 spores/mL) and Rs (2% w/v) in twelve treatment combinations arranged in a randomized block design. After 60 days of pathogen inoculation, leaf samples were collected and analyzed for key physiochemical parameters.

Results

Pathogen infection significantly altered plant biochemistry. Proline increased 2.3-fold (Fol) and 2.6-fold (Rs), while glycine betaine rose 3.2-fold and 3.8-fold, respectively. Total soluble sugars decreased by ~50%, and chlorophyll content was reduced by 71–72% relative to controls; carotenoids declined by 21% (Fol) and 41% (Rs). Seed priming with Tv and/or JA improved osmolyte accumulation, pigment restoration, and secondary metabolite content. Notable effects included maximum proline in all primed treatments except Rs+Tv, highest glycine betaine in Rs+Tv+JA, significant sugar recovery in Fol+JA, Fol+Tv, and Fol+JA+Tv, and substantial chlorophyll restoration in Fol+Tv+JA (123.9%) and Rs+Tv+JA (111.6%). Tv and Tv+JA effectively restored carotenoids in both pathogenically infected plants. Fol+Tv+JA increased anthocyanins by 45.5%, flavonoid content peaked in Rs+Tv+JA (0.63 mg g⁻¹ FW), while phenolic content was higher in Rs than Fol but remained unaffected by priming.

Conclusion

Seed bioprimering with Tv and JA effectively mitigates pathogen-induced biochemical impairments, enhancing stress resilience in tomato. This eco-friendly strategy offers a viable alternative for sustainable disease management.

Keywords: Bioprimering, Biocontrol agent, Phytohormone, Secondary metabolites, Pigments, Fusarium wilt, Damping off

Protected Cultivation as a Climate-Resilient Approach for Enhancing Growth and Morpho-Physiological Performance of Okra (*Abelmoschus esculentus* L.)

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ABSTRACT

Raising temperature, change in weather patterns, erratic rainfall conditions, characterized as Climate change, stances a major threat to vegetable cultivation. Protected cultivation provides a feasible adaptation strategy by modifying the microclimate, reducing the environmental stress on crops. This study delves into the growth and morpho-physiological aspects of the NS774 cultivar under both protected and open field conditions. The primary objective of this study was to analyze the impact of protected environments on overall plant growth and physiological processes. Representative plants at the various growth stages were assessed for shoot length, root length, leaf area, fruit length, and physiological traits, including chlorophyll content, Net Photosynthetic Rate (NPR), Stomatal Conductance (SC), and Transpiration Rate (TR). Protein analysis by SDS-PAGE was performed to assess the expression. Results showed that protected-grown plants exhibited greater plant height, along with lower TR compared to open-field plants. Furthermore, the fruit length was sustainable in protected cultivation compared to open field conditions. Protein band intensity was also greater in protected-grown plants, indicating enhanced metabolic activity under moderated environmental conditions. These findings support protected cultivation as an effective strategy to sustain okra productivity and quality under changing climatic conditions and offer valuable insights for enhancing agricultural productivity in diverse climatic conditions by depicting that more protected cultivation must be practiced for crops like okra.

Keywords: Okra; Protected cultivation; climate resilience; Morpho-Physiology; Microclimate; Protein content

Spatio-Temporal Analysis of Half-Monthly Methane Emissions in Haryana's Kharif Season
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ABSTRACT:

Methane is second most significant factors among greenhouse gases. An advanced geo-informatics technique has used to analyse methane emission mixing ratio from rice and wheat crops in Haryana. Primary objective of study is quantification of methane emissions, their spatial and temporal patterns, and their environmental impact. Methane mixing ratio data obtain by Sentinel-5P data containing methane concentration information. The study integrates data from remote sensing, geospatial analysis, satellite observations, ground measurements, and modelling to comprehensively assess methane emissions associated with crops cultivation.

This research provides a detailed examination of half-monthly methane emission mixing ratios linked to the practice of burning rice stubble in October and November month within the Haryana region. The study employs advanced geo-informatics methods, including cutting-edge technologies like remote sensing and Geographical Information Systems (GIS), to systematically assess and monitor these emissions on a semi-monthly basis. The findings from this study have consistency in land area categorization during certain months suggests potential uniformity in land usage.

Keywords: Methane Mixing Ration, Kharif, Geoinformatics, Remote Sensing

Assessing The Impact of Phosphorus Sources Along with Phosphate Solubilizing Bacteria in Tomato (*Solanum lycopersicum* L.) Rhizosphere

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ABSTRACT

The present study entitled "Assessing the Impact of Phosphorus Sources along with Phosphate Solubilizing Bacteria in Tomato (*Solanum lycopersicum* L.) Rhizosphere" was conducted during Rabi season 2024-25 at the Division of Soil Science and Agricultural Chemistry, SKUAST-Jammu. The pot experiment was laid out in a factorial completely randomized design with three replications comprising twenty treatment combinations. The treatments included combinations of four phosphorus sources—P₀ (Control), P₁ (Di-ammonium phosphate), P₂ (Rock phosphate), and P₃ (Tri-calcium phosphate)—and four PSB sources—B₀ (Control), B₁ (*Bacillus subtilis*), B₂ (*Pseudomonas fluorescens*), B₃ (Pusa Sampoon), and B₄ (Commercial-Market ready). Seedlings of tomato (var. Pusa Ruby) were primed and inoculated with respective PSB formulations before transplanting.

Combined application of phosphorus sources and PSB significantly enhanced soil biological properties and nutrient availability. All the treatments exhibited significant improvement in nutrient availability nitrogen, phosphorus, and potassium. The highest available phosphorus (17.92 mg kg⁻¹), nitrogen (105.03 mg kg⁻¹), and potassium (98.37 mg kg⁻¹) were recorded in treatment P₁B₃ (DAP + Pusa Sampoon), which remained statistically at par with P₁B₁ (DAP + *Bacillus*) in terms of available N, P and K, indicating that multiple PSB strains in combination with DAP were similarly effective. Enhanced microbial activity was also observed in P₁B₃, recording the highest dehydrogenase activity (76.59 µg TPF g⁻¹ soil hr⁻¹), phosphatase activity (74.35 µg PNP g⁻¹ soil hr⁻¹), soil microbial biomass carbon (100.19 mg C kg⁻¹ soil), soil microbial biomass nitrogen (28.53 mg N kg⁻¹ soil), and soil microbial biomass phosphorus (15.43 mg P kg⁻¹ soil) at flowering stage, with values statistically at par with P₁B₁ (DAP + *Bacillus*). Among phosphorus fractions, Ca-P showed significant improvement at harvest, with the highest value (183.13 mg kg⁻¹) under P₁B₃ (DAP + Pusa Sampoon). Other fractions Al-P (53.35 mg kg⁻¹), Fe-P (87.18 mg kg⁻¹), and Labile-P (48.26 mg kg⁻¹) also recorded their highest values under the

same treatment P₁B₃ (DAP + Pusa Sampooran). Significant improvement in yield and quality parameters was also observed. P₁B₃ resulted in maximum plant height (85.45 cm), fruit weight (60.09 g), number of fruits per plant (18.45), and fruit yield (1.26 kg plant⁻¹), followed closely and at par by P₁B₁. Quality parameters such as ascorbic acid (20.96 mg 100g⁻¹), and TSS (3.87 °Brix) were also highest in P₁B₃. Nutrient uptake values were also maximum in P₁B₃: nitrogen uptake (1.13 g pot⁻¹), phosphorus uptake (0.23 g pot⁻¹), and potassium uptake (1.05 g pot⁻¹) and was statistically at par with P₁B₁.

Overall, the treatment P₁B₃ (DAP + Pusa Sampooran) consistently outperformed other combinations among other studied parameters. However, P₁B₁ (DAP + *Bacillus*), P₁B₂ (DAP + *Pseudomonas*), also demonstrated statistically comparable results in many aspects, highlighting the synergistic potential of using efficient PSB strains with suitable phosphorus sources (DAP and Rock phosphate) in present study. The integrated application of phosphorus sources with PSB significantly improved soil fertility, nutrient uptake, yield, and quality of tomato, offering a sustainable and effective approach for tomato cultivation.

Keywords: Tomato, Phosphorus, PSB, DAP, Rhizosphere, Enzymes, Soil fertility, Microbial biomass, Yield, Quality

Characterization of *Phaseolus vulgaris* L. for nutritional parameters

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ABSTRACT

Phaseolus vulgaris L. or French bean is an important source of good quality proteins especially for the vegetarian population. Apart from being a prominent source of proteins, it is also rich in vitamins, minerals and other healthy building components like antioxidants. However, presence of certain antinutritional factors interfere and reduce the nutritional excellence of these beans. We characterised 100 genotypes of French bean with respect to various nutritional and anti-nutritional factors, and studied correlation among these. Significant variability and high heritability was observed among the genotypes for these traits, thereby indicating the possibility of selections in further improvement. In the present study, the protein content among the genotypes ranged from 1.06 to 11.59 percent and the total sugars from 2.05 to 17.69 percent. Phenols and flavonoids varied from 25.11 to 125.34 mg/100g and 19.47 to 70.21 mg/100g, respectively. Similarly, the minerals, vitamins and antinutritional factors too had significant range of variation among the genotypes studied. Perusal of data and correlation among various nutritional parameters indicated the possibility of improvement of genotypes in terms of nutritional quality while reducing the antinutrients without compromising the crop yield.

Keywords: *Phaseolus vulgaris*, beans, variability, nutritional composition, antinutrients

Traditional Diet and Medicine with Scientific Approach for Overall Health and Wellbeing**Sangeeta***Food & Nutrition, Ramabai Govt. Women Post Graduate College, Akbarpur Ambedkarnagar (U.P.) India***ABSTRACT**

Traditional system of diet and Indian medicine were rich heritage of ancient period. People follow natural remedies for treatment and healing and grow nutritious food crops, vegetable, millets for good gut health and wellbeing. Indian culture and medicine system offer a diverse range of approaches to health and healing, rooted in ancient wisdom and holistic principles. Modern diet and medicine system widely recognised and supported with government scheme and practices like AYUSH system of Ayurveda treatment, where medicine used as a part of food not chemical combination and this system of treatment uses particular diet pattern, this systems are playing an increasingly important role in India's healthcare landscape. Ayurveda is accepted to be the oldest medical system, which came into existence in about 900 B.C. The word Ayurveda means Ayur, meaning life and Veda, meaning science. The Ayurveda is said to be an Upaveda of Atharva Veda. Charaka Samhita is the first recorded book with the concept of the practice of Ayurveda. This describes 341 plants and plant products used in medicine. Sushruta Samhita 600 B.C. was the next Ayurveda literature that has special emphasis on surgery. It described 395 medicinal plants, 57 drugs of animal origin, 4 minerals and metals as therapeutic agents.

Integrating Traditional diet and medicine systems with modern scientific approaches involves validating traditional practice through scientific method and exploring their potential benefits with in broader healthcare framework. This approach exemplified by the Indian Traditional system aims to enhance healthcare accessibility and effectiveness by combining the strength of both systems. Objectives of the study: Present study was conducted to assess the acceptance and practices of traditional diet and Indian medicine system by new generation for health wellbeing.

Keywords: Traditional Diet, Medicine, Health, Scientific Approach, Global and Holistic Approach.

Evaluation of carbon sequestration potential of different multipurpose trees of Arunachal Pradesh**R.A. Alone*, Doni Jini, Thejangulie Angami, Ampee Tasung, Rajesh Khan, K. Bhagawati and L. Wangchu***ICAR Research Complex for NEH region, Arunachal Pradesh centre, Basar 791 101***ABSTARCT**

Carbon fixation through forestry is primarily determined by the amount of biomass produced in a given area. Agroforestry is a very efficient way of promoting biomass and carbon accumulation. Plantations of 9 multipurpose trees viz. *Cinnamomum camphora*, *Terminalia myriocarpa*, *Michelia obtusifolia*, *Castanopsis indica*, *Symmingtonia populnea*, *Manglietia insignis*, *Altingia excelsa*, *Ixonanthus Khasiana* and *Gmelina arborea* are being evaluated at ICAR Research Farm, Basar for biomass production and carbon sequestration potential. The component-wise biomass was estimated for all 9 plantations using the allometric equations developed relating Girth at Breast Height (GBH) with the dry weight of tree components.

The highest bole biomass (203.64 t/ha), branch biomass (171.09 t/ha), foliage biomass (42.06 t/ha), root biomass (54.50 t/ha) and total biomass (471.34 t/ha) was recorded in *Castanopsis indica* followed by *Altingia excelsa* where bole biomass (244.79 t/ha), branch Biomass (63.35 t/ha), foliage biomass 37.77 t/ha), root biomass (76.55 t/ha) and total biomass was recorded 422.47 t/ha.

The highest bole carbon stock (88.58 t/ha), branch carbon stock (78.13 t/ha), foliage carbon stock (19.64 t/ha), root carbon stock (19.48 t/ha) and total carbon stock (205.85 t/ha) was recorded in *Castanopsis indica* followed by *Altingia excelsa* where bole carbon stock (106.48 t/ha), branch carbon stock (28.93 t/ha), foliage carbon stock (17.62 t/ha), root carbon stock (27.36 t/ha) and total carbon stock was recorded 180.41 t/ha.

The plantation of *Castanopsis indica* also recorded the highest net primary productivity $72.09 \pm 4.78 \text{ t ha}^{-1} \text{ year}^{-1}$ and carbon sequestration potential $32.82 \pm 2.43 \text{ t ha}^{-1} \text{ year}^{-1}$ followed by plantations of *Altingia excelsa* which recorded the net primary productivity $61.28 \pm 3.85 \text{ t ha}^{-1} \text{ year}^{-1}$ and carbon sequestration potential $30.19 \pm 1.63 \text{ t ha}^{-1} \text{ year}^{-1}$.

Keywords: Biomass, carbon stock, Net primary productivity, carbon sequestration

Economic Duality and Transgender Inclusion in Urban India: Evidence from Delhi-NCR

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ABSTRACT

Transgender individuals in India continue to face systemic socio-economic exclusion despite recent notable legal recognition and policy advancements. This study introduces the concept of *economic duality*—the concurrent participation of transgender individuals in both mainstream employment and survival economies, such as sex work and begging. The phenomenon reflects the limitations of current inclusion frameworks, which emphasize access but often overlook structural inequities, wage disparities, and social stigma.

Methodology: Using primary survey data from 335 transgender individuals in Delhi-NCR, this study employs descriptive statistics and a binary probit regression to analyse the determinants of participation in mainstream and survival economies. The model considers key demographic variables such as gender identity, age, education level, and income quintile, with marginal effects estimated and plotted for interpretation.

Results: Higher education and income levels significantly increase the probability of engagement in mainstream economies, while transgender identity is independently associated with reduced access. Conversely, low income and limited education correlated strongly with reliance on survival economies. Notably, even those in formal employment often supplement their income through informal work, reinforcing the reality of economic duality.

Conclusion: The findings, interpreted through *Amartya Sen's Capability Approach* and *Queer Political Economy*, reveal that formal economic inclusion does not guarantee dignity, stability, or empowerment. The study advocates for structural interventions—such as affirmative hiring, wage equity, and targeted financial services—to dismantle economic duality and promote sustainable economic inclusion for transgender individuals in India.

Keywords: Transgender, mainstream economies, survival economies, economic duality, marginalization.

Awareness and Consumption of Pearl Millet among School-Going Adolescents in Lucknow District, Uttar Pradesh, India: A Comparative Study**Prachi Verma¹, Archana Saxena² and Rashmi Singh³**^{1,2} Department of Home Science, CSJM University, Kanpur³ Food and Nutrition, CSA University of Agri. & Tech. Kanpur**ABSTRACT**

The production and consumption of pearl millet have decreased over time for several reasons. Alterations in dietary habits have led to nutritional deficiencies and various health issues. Recently, pearl millet has seen a resurgence in popularity because of its health benefits, minimal agricultural requirements, lower irrigation needs, potential to address climate change, and its role in ensuring food and nutritional security. To assess the current level of awareness and consumption of pearl millet, a study was carried out in Uttar Pradesh. Assessing pearl millet awareness and consumption behavior among school-going adolescents of rural and urban areas of Uttar Pradesh was the goal of the current study. Questionnaires were administered in a cross-sectional approach to investigate the awareness and consumption behavior of pearl millet in the Lucknow districts of Uttar Pradesh, including rural and urban areas. Adolescents in the 9th to 12th grades from rural (n=200) and urban (n=200) areas in Lucknow district were recruited for the study. To find the association between categorical variables, a Chi-square test was used. It was found that the majority of the respondents (98%) stated that they were aware of pearl millet, whereas the remaining 8% stated that they were unaware of pearl millet. It was also observed that out of 98% school children who reported being aware of pearl millet, 33% stated that they were aware of sorghum, finger millet, barnyard millet, and kodo millet. Pearl millet consumption and awareness were significantly correlated at 5% among adolescents enrolled in school in both rural and urban settings. These findings indicated that school-going adolescents' pearl millet consumption is influenced by their knowledge about millet. Therefore, it is necessary to conduct nutrition education on millet to raise awareness among students, which may further encourage millet consumption.

Keywords: pearl millet, pearl millet awareness, pearl millet consumption, adolescents

Potentiality and Suitability of Makhana (*Euryale ferox* Salisb.), a Minor Fruit Crop in Waterlogged Areas**Anil Kumar^{1*}, P.K. Yadav², Tapan Gorai³, Ruby Saha⁴, D.K. Mahato⁵, M.B. Thakur⁶, Satish K Yadav⁷, I.S. Singh⁸ and Paras Nath⁹**^{1,3,4,5,6} BPS Agricultural College, Purnea, BAU Sabour² IRS, Madhepura, BAU Sabour⁷ ICAR-NBPGR, New Delhi⁸ ICAR-NRC, Makhana, Darbhanga⁹ VKS College of Agriculture, Dumraon, BAU Sabour**ABSTRACT**

Makhana, or *Euryale ferox* Salisb., traditionally known as gorgon nut, is an aquatic plant cultivated for its edible seeds. Though typically not classified as a fruit crop in the commercial horticultural sector, it holds tremendous potential as a minor fruit crop due to its nutritional value, market demand, adaptability to wetland ecology, and scope for income generation—especially in North Bihar. It belongs to Nymphaeaceae family. Due to low fat (0.1 g) content, high contents of carbohydrates (76.9 g), proteins (9.7 g) and minerals (0.5 g) it is considered as dry fruit (panchmewa) and is comparable to other dry fruits such as almond, walnut, cashew nut and coconut. The calorific value of raw seeds (362 kcal / 100 g) and puffed seeds (328 kcal / 100 g) lie close to staple foods like wheat, rice, other cereals and some aquatic plants like Nelumbo and Trapa. Makhana has medicinal uses in the Indian system of medicine

and is recommended for treatment of many diseases specially rheumatic disorders and bile disorders. Makhana is used as a tonic and for the treatment of leucorrhoea and good immune-stimulant. The seeds, were in size of 1 mm to 14 mm in diameter and black in colour and eaten as roasted pop or immature fruits. The average yield of makhana was estimated to be 20 -22 quintals / hectare. Keeping in view the potential of this minor fruit crop in India, an exploration trip was conducted in northern districts of West Bengal. The samples were collected from 10 m amsl to 45 m amsl particularly in the makhana rich diversity regions of Cooch Behar, Islampur and Malda. The trip was conducted by ICAR- NBPGR, New Delhi in coordination with BPS Agricultural College, Purnea, BAU Sabour. The tremendous genetic diversity in collected germplasm of Makhana can be used for makhana crop improvement. Thousands of hectares' low lying areas inundated throughout the year due erratic rainfall and flooding as consequence of climate change. These land are still underutilized and Makhana based cropping system as well as farming system enhanced the production, productivity and profitability of ponds and wetlands.

Keywords: Wetland, genetic diversity, superfood

Research Advancements Towards Smart Metering Mechanism in Sweet Corn Planter

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ABSTRACT

Precision agriculture, a key enabler of sustainable development, employs advanced technologies to enhance crop productivity while reducing environmental impact. Conventional planters rely on mechanically driven seed metering mechanisms powered by ground wheels via gears, chains, or belts, which suffer from transmission losses, frictional wear, and reduced precision. To overcome these limitations, a battery-operated corn planter with an electronic sensor-based metering mechanism was developed. The system integrates a photoelectric sensor, proximity sensor, and microcontroller to synchronize a DC motor with the metering unit, ensuring uniform row-to-row and seed-to-seed spacing, thereby minimizing missed seeds and multiple drops.

Advances in precision seeding are driving development of smart metering mechanisms specifically adapted for sweet corn, a crop whose seed size, planting density and market value demand high singulation accuracy and reliable on-the-go monitoring. This study synthesizes recent progress in three linked areas: (1) electric-drive metering units that provide per-row variable-rate control, instantaneous start/stop and improved spacing consistency compared with ground-driven systems; (2) multimodal row-level sensing — including optical/photoelectric, capacitive and vision systems combined with encoder timing to detect skips, doubles and irregular drops in real time; and (3) embedded control and sensor-fusion approaches (edge ML, CAN/ISOBUS integration and data logging) that enable automated corrective actions such as pulse replanting or targeted supplemental seeding. Laboratory and field evaluations for maize/sweet-corn type planters show that electric actuation plus multi-sensor fusion substantially reduces spacing variability at varying forward speeds and supports reliable monitoring under typical field disturbances; however, challenges remain in robust vision/acoustic performance under dust and vibration, energy/latency constraints for per-row controllers, and cost-effective retrofits for small operations. We conclude that coupling electric metering with lightweight edge intelligence and sensor fusion is the most promising path to scalable smart sweet-corn planters, and we identify experimental priorities: multispectral/vision datasets for sweet corn seeds, high-speed singulation testing, and low-cost retrofits for smallholders.

Keywords: sweet corn, smart metering, electric-drive seed meter, seed singulation, sensor fusion, edge ML.

Role of Capacity Development Initiatives in Advancing VCM in Indian Agriculture**Ishtiyak Ahmad Peerzada^{1*}, A.H. Mughal¹ and Mohan Reddy²**¹*Faculty of Forestry, SKUAST-Kashmir, India*²*International Institute for Environment and Development (IIED), London***ABSTRACT**

Global CO₂ concentrations have surpassed 400 ppm and may rise to 700–900 ppm due to industrial activities, intensifying climate change. As the world's third-largest greenhouse gas emitter, India has pledged to cut one billion tons of carbon emissions by 2030. Agriculture, which contributes 18.6% to India's GDP, is both vulnerable to climate impacts and offers considerable carbon sequestration potential. Sustainable agricultural practices (SAPs), backed by government initiatives, can boost carbon capture while delivering environmental benefits. The agricultural Voluntary Carbon Markets (VCM) provides an opportunity to lower emissions, build resilience, and position the sector as a significant contributor to climate mitigation. Effective VCM participation requires coordinated efforts among the Department of Agriculture and Farmers Welfare (DA&FW) for policy leadership, the Indian Council of Agricultural Research (ICAR) and State Agricultural Universities (SAUs) for technical expertise and farmer engagement, regulators for compliance, verification bodies for outcome validation, carbon market developers for project creation, financial institutions for funding, and farmers for on-ground adoption. While DA&FW holds foundational capacity, improvements in policies, regulatory frameworks, farmer awareness, and infrastructure are essential. ICAR and SAUs provide methodologies and farmer outreach, but farmers and partners need enhanced funding, awareness, and technical training. A Capacity Needs Assessment (CNA) shows that India's VCM framework is still developing and requires substantial investment in skilled personnel, resources, and process efficiency. Key priorities include boosting awareness, strengthening technical support, and improving operational systems. The CNA identifies training needs in policy frameworks, methodologies, and stakeholder engagement. Addressing these gaps through a strategic, multi-stakeholder capacity development approach will strengthen collaboration, accelerate project implementation, and advance India's agricultural VCM participation toward meeting national climate goals.

Keywords: Climate Mitigation, VCM, Agriculture, India**Agronomic Biofortification with Zinc and Iron for Improving Yield and Nutritional Quality of Pigeonpea (*Cajanus cajan* L.) under Indian Agro-Climatic Conditions****Milind Dattatraya Giri^{1*}, S. Anitta Fanish², Prashant Atmaram Pagar³, Shankar Lal Yadav⁴, and Ram Swaroop Narolia⁴**¹*Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola 444104 (Maharashtra), India.*²*Tamil Nadu Agricultural University, Coimbatore 641003 (Tamil Nadu), India.*³*Vasantrao Naik Marathwada Agricultural University, Parbhani 431402 (Maharashtra), India.*⁴*Agricultural University, Kota 324001 (Rajasthan), India.***ABSTRACT**

Agronomic biofortification is an effective and sustainable strategy for addressing micronutrient deficiencies, particularly in regions where food insecurity is a significant challenge. This study aimed to evaluate the impact of foliar applications of zinc (Zn) and iron (Fe) on the growth, yield, and nutritional quality of pigeonpea (*Cajanus cajan*) across four agro-climatic locations in India: Akola (Maharashtra), Coimbatore (Tamil Nadu), Badnapur (Maharashtra), and Kota (Rajasthan). A field experiment was arranged in a split-plot design to assess the effects of eight different timings for Zn and Fe foliar applications, including at flower initiation, pod initiation, and both stages combined. The results indicated that applications of Zn and Fe at critical reproductive stages significantly improved

yield attributes, including plant height, number of pods, and seed weight, with the most notable improvements in seed and stalk Zn and Fe concentrations. Among the locations, Akola recorded the highest seed Zn content, while Coimbatore exhibited the highest seed Fe concentrations. The seed yields were consistently higher at Kota. Badnapur showed the lowest seed Fe concentrations. Based on these results, our study highlights the potential of agronomic biofortification in improving the nutritional quality of pigeonpea, offering a practical solution to mitigate hidden hunger and improve the health of populations reliant on this crop.

Keywords: Agro-climatic, Biofortification, Agronomic and Nutritional Quality

Traditional Knowledge and Utilization of Medicinal Plants for Human Ailments in Kupwara, Kashmir Himalaya

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ABSTRACT

Medicinal plants have played a pivotal role in human healthcare for thousands of years and continue to serve as an important source of therapeutic agents worldwide. In many rural and developing regions, traditional plant-based remedies remain the primary mode of treatment, complementing or even substituting modern healthcare systems. The Kashmir Himalayas represent a rich repository of medicinal flora, with centuries-old ethnobotanical knowledge preserved within local communities. The present study documents and analyzes the traditional use of medicinal plants for treating human ailments in the hilly areas of District Kupwara, Jammu and Kashmir. Data were gathered through extensive field surveys, employing semi-structured interviews and group discussions with 60 informants, including tribal families, local medical practitioners, traditional healers, and knowledgeable elders. Interviews were conducted primarily in the local language to ensure accuracy and cultural relevance. Information recorded included plant species, vernacular names, plant parts used, methods of preparation, modes of administration, and specific ailments treated. Knowledge was cross-verified between informants and healers to ensure reliability. The study documented 33 plant species belonging to 21 families, with Asteraceae being the most represented family, followed by Lamiaceae and Polygonaceae. A variety of plant parts were employed in remedy preparation, including leaves, whole plants, fruits, seeds, roots, flowers, rhizomes, and bark. The findings highlight the critical role of herbal medicine as an integral component of primary healthcare in the study area, reflecting a deep cultural reliance on plant-based remedies. However, the erosion of traditional knowledge due to modernization and limited documentation underscores the urgent need for conservation efforts, both for the medicinal plant species and the associated ethnobotanical heritage.

Keywords: Ethnobotany, Medicinal plants, Traditional knowledge, Herbal remedies, Kupwara, Kashmir Himalaya

Dynamics of weather parameters and climatic extremities across the coastal region of Andhra Pradesh**Apoorva Veldandi^{1*}, Siddhesh Zade¹, Parjanya Pavan², Amitava Panja¹, Sanchita Garai¹ and Sanjit Maiti¹**¹*Dairy Extension Division, ICAR-National Dairy Research Institute, Karnal*²*Division of Agricultural Extension, ICAR-Indian Agricultural Research Institute, New Delhi***ABSTRACT**

The present study investigates that temporal dynamics and climatic extremities of the critical weather parameters across the nine coastal districts of Andhra Pradesh for the past seventy years (1951-2024). Gridded daily rainfall data with a resolution of 0.25×0.25 while daily temperature gridded data with 0.5×0.5 resolution in a NetCDF file were downloaded from IMD website from which data extraction was carried out using Python. For calculating temperature-humidity index, the monthly and annual temperature at 2 meters and relative humidity at 2 meters data was downloaded from NASA Power Data Access Viewer and formula given by National Research Council was used. Trend metrics, temperature anomaly index and rainfall anomaly index were computed with the extracted data. Seasonally-resolved analysis identified monsoon and pre-/post-monsoon contributions to observed trends. Results revealed statistically significant warming in coastal and near-shore districts, shifts in monsoon onset and intensity, increasing frequency of short-duration heavy precipitation events, and rising heatwave days concentrated in the coastal region of Andhra Pradesh. The study links observed changes to potential impacts on agriculture, dairy, freshwater availability and coastal livelihoods and offers targeted adaptation recommendations, including water resource planning, heat-resilient livestock and crop practices, and early-warning improvements. Findings contribute high-resolution, policy-relevant evidence for coastal climate risk management in Andhra Pradesh.

Keywords: Andhra Pradesh, Coastal Region, Climatic Extremities, Dynamics, Weather parameters**Seasonal Influence of Jeevamrut and Vermiwash on Yield and Quality of Tomato under Rooftop Farming Conditions****M.D. Giri, Neetu Kumawat, Indira B. Soneji, V.S. Kale, and N.K. Patke***Department of Agronomy, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola 444 104 (Maharashtra), India.***ABSTRACT**

The study was conducted to assess the effects of bio-organic liquid fertilizers jeevamrut and vermiwash on the growth, yield, and quality of tomato (*Lycopersicon esculentum* Mill.) grown under terrace farming conditions. The experiment took place during the *Rainy* and *Winter* seasons of 2024–25 at the Urban Terrace Farming Research Facility, Department of Agronomy, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Krishi Nagar, Akola 444 104 (Maharashtra). It used a Randomized Block Design with four replications and six treatments: T₁- applying jeevamrut at 10, 20, 30, 40, 50, and 60DAP; T₂- applying jeevamrut at 20, 40, and 60 DAP; T₃- applying vermiwash at 10, 20, 30, 40, 50, and 60DAP; T₄- applying vermiwash at 20, 40, and 60 DAP; T₅- control (no added nutrients); and T₆- conventional fertilization through RDF. Jeevamrut and vermiwash were prepared using traditional methods and applied via drip irrigation according to the treatments. Observations included plant height (cm), number of branches per plant, leaf area (cm²), dry matter per plant (g), number of fruits plant⁻¹, average fruit weight (g), and total fruit yield plant⁻¹ and m⁻¹⁻², along with quality parameters such as total soluble solids (°Brix), ascorbic acid (mg⁻¹ 100 g), lycopene content (mg⁻¹ 100 g), titratable acidity (%), polar diameter (cm), and equatorial diameter (cm). Results showed that the conventional fertilizer treatment (T₆) achieved the significantly higher performance in vegetative growth, fruit yield (3.51 kg⁻¹m²),

average fruit weight (90.82 g), TSS (5.57 °Brix), and lycopene content (5.53 mg⁻¹ 100 g). Conventional treatment also produced significantly higher nutrient content and uptake by the tomato plants. Among the organic treatments, vermiwash (T₄) outperformed jeevamrut (T₂), with higher fruit yield (2.73 kg⁻¹ m² compared to 2.54 kg⁻¹ m²) and superior quality traits, likely due to its higher content of plant hormones, micronutrients, and beneficial microbes. Both organic and natural farming treatments markedly enhanced plant growth and fruit quality over the control (T₅), which recorded the lowest yield (2.06 kg⁻¹ m²) and quality parameter. Seasonal variation influenced the results, with better performance in the Winter season (average yield 3.00 kg⁻¹ m²) compared to *Rainy* (average yield 2.54 kg⁻¹ m²), due to cooler temperatures, lower humidity, and better light conditions.

While conventional fertilizers delivered maximum productivity, the use of jeevamrut and vermiwash offered a sustainable and eco-friendly alternative with satisfactory yield, improved fruit quality, and longer shelf life (7.33 days in T₂ and 7.67 days in T₄), making them suitable for urban organic farming. The study supports the integration of organic nutrient management in terrace farming to enhance urban food security and promote environmentally resilient agricultural practices.

Keywords: Rooftop, Farming, Tomato, Yield

Use of Modified Atmospheres for Stored Product Pest Control

Abhishek Yadav

KVK, Ballia, ANDUAT, Kumarganj, Ayodhya, U.P. (224229)

ABSTRACT

The flare-up of human population is creating an unprecedented demand for greater production of food grains. The post-harvest losses due to infestation by insect pests have required the use of diverse procedures for their control. In the recent past, the preservation of agricultural products during the storage has relied heavily upon the insecticides to control the storage pests. These management strategies have more side effects on the environment, human health and the consumers today expect the food products that are pesticide free. Hence, there is a need of eco-friendly methods to manage the storage pests. Modified or controlled atmospheres offer a safe and environmentally benign alternative to the use of conventional residue-producing chemical fumigants for controlling insect pests that attack stored grain. The modified atmosphere storage method involves alternation of the concentrations of the normal atmospheric gases such as nitrogen, oxygen and carbon dioxide, to an atmosphere lethal to stored product pests. This modified atmosphere storage has many advantages compare to conventional methods of storage. These includes elimination of insects from stored commodities without polluting the atmosphere, no harmful residues remain after the treatment of the commodity with nitrogen, oxygen and carbon dioxide, absence of effects on germination, many other parameters important in the quality of different commodities and decreased hazard of leakage into workspace of toxic material. These advantages, together with cost competitiveness against many existing practices, ensure that modified atmospheres will be used on a routine basis as a method of insect control in stored products in the future.

Keywords: Pest Control, Insect, Atmospheres

Effect of planting method and strip-intercropping on productivity and resource use efficiency in wheat based cropping systems**Mrinal Sen***Department of Agronomy, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh-221005***ABSTRACT**

Wheat (*Triticum aestivum* L.) is the second most important cereal crop in India, making a significant contribution to food and nutritional security. It is well known that intercropping, especially strip-intercropping, can increase system profitability, productivity, and resource efficiency while preserving ecological balance. A field experiment was conducted at ICAR-IARI, New Delhi in the rabi season of 2021–2022. The experiment used a strip-plot design, with two planting techniques (flatbed and ridge and furrow) as horizontal plots and seven strip-intercropping treatments as vertical plots. The objective was to assess how various crop combinations and planting techniques affected wheat-based systems' yield, economics, and resource efficiency. The experimental soil was sandy loam with 0.48% organic carbon, pH 7.9, bulk density 1.52 Mg/m³, and available N, P, and K of 232, 16, and 263 kg/ha, respectively. While chickpea performance was best under sole cropping but statistically comparable to wheat + chickpea (75:25), wheat growth, yield attributes, and productivity were significantly improved by wheat + chickpea (75:25) strip-intercropping over sole wheat. When grown as a sole crop, mustard produced the highest yield, which was similar to that of wheat + mustard (75:25). For all crops, ridge and furrow planting continuously performed better in terms of growth and productivity than flatbed. According to studies on soil moisture, sole wheat mostly used the top 30 cm of soil, while sole mustard and chickpeas drew more water from the depths below 30 cm. More evenly, moisture was accessed by intercropping systems across soil layers. Sole mustard had the highest P uptake, while wheat + chickpea (75:25) had the highest total N and K uptake. When compared to flatbed, ridge and furrow planting enhanced the uptake of all three nutrients. Resource use efficiency in terms of water productivity, PFP_P, and PFP_K, was highest in sole wheat and ridge and furrow planting, with water productivity statistically similar in wheat + chickpea (75:25). The sole chickpea under ridge and furrow had the highest PFP_N. While dehydrogenase activity peaked in sole chickpea, microbial biomass carbon and fluorescein diacetate activity peaked in wheat + chickpea (75:25). Microbial indicators were not significantly impacted by the planting method. The wheat + chickpea (75:25) system recorded the highest LER and wheat equivalent yield (8.5% higher than sole wheat), along with greater economic returns and a 13.94% increase in net B:C ratio. Ridge and furrow planting further improved productivity and profitability. It can be concluded that wheat + chickpea (75:25) under ridge and furrow planting is a profitable, resource-efficient, and soil-friendly option for wheat-based systems.

Keywords: Strip-intercropping, planting methods, ridge and furrow, wheat + chickpea intercropping, wheat + mustard intercropping

Physicochemical and Sensory Evaluation of Crackers Enriched with Rice Bran**Anisha Verma¹, Akanksha Singh² and Ranu Prasad³**¹*Department of Food and Nutrition, College of Community Science, ANDUAT, Kumarganj, Ayodhya*^{2,3}*Department of Food Nutrition and Public Health, College of Community Science, SHUATS, Prayagraj***ABSTRACT**

The aim of this study was to develop a ready-to-eat snack—rice bran crackers—by incorporating rice bran into the formulation. The bakery sector, a major component of India's food processing industry, has witnessed growing consumer demand due to the convenience, availability, and extended shelf-life of its products. Enriching crackers with rice bran was explored as a means to improve their nutritional value. Rice bran, a by-product generated during the polishing of unmilled rice, is rich in essential nutrients including fiber, vitamins, and minerals. In this study, crackers were formulated by combining all-purpose flour, rice bran, flaxseed, and rice flour in varying proportions across three treatments T₁ (70g all-purpose flour, 10g rice bran, 10g flaxseed, 10g rice flour), T₂ (60g all-purpose flour, 20g rice bran, 10g flaxseed, 10g rice flour) and T₃ (50g all-purpose flour, 30g rice bran, 10g flaxseed, 10g rice flour). A control sample (T₀) was also prepared using 80g all-purpose flour and 20g rice flour. Proximate and mineral composition of the crackers was analyzed using standard AOAC methods, and statistical significance among samples was assessed using ANOVA, Critical Difference (CD), and t-tests. Instrumental methods were also employed to evaluate the crackers' functional properties. Sensory evaluation revealed that crackers with 30g rice bran (T₃) received the highest acceptability scores, followed by T₂ and T₁, indicating a positive correlation between rice bran incorporation and consumer preference. The best-performing treatment (T₃) demonstrated superior nutritional content compared to the control. Moisture 4%, Ash 2.21g, Protein 17.56g, Fat 24.7g, Fiber 4.78g, Carbohydrates 52.8g, Energy: 503 kcal per 100g. However, higher rice bran content also resulted in a decrease in spread factor and water activity. Cost analysis per 100g of crackers was as follows T₀ ₹25.60, T₁ ₹22.08, T₂ ₹27.38, T₃ ₹30.72. In conclusion, the incorporation of rice bran, flaxseed, and rice flour in cracker formulation significantly enhanced the nutritional profile and quality of the product. This suggests a promising approach for producing functional, health-enhancing snacks using nutrient-rich by-products like rice bran.

Keywords: Rice flour, Rice Bran, Flaxseed, Crackers, Sensory Attributes, Functional Properties.**Organic Farming and Residue-Free Food Production****Ganesh Patekar¹ and Vishakha Bansal²**¹*Dept (Extension Education and Communication Management), Collage of Community and Applied Sciences, MPUAT, Udaipur 313001***ABSTRACT**

In order to support long-term agricultural productivity, consumer health, and environmental sustainability, organic farming and residue-free food production are essential. Based on ecological principles, organic farming enhances soil fertility through crop rotation, composting, green manures, and biological pest management while avoiding synthetic fertilizers, pesticides, and genetically modified organisms. In order to ensure food safety and reduce environmental pollution, residue-free food production places an emphasis on growing crops without leaving dangerous chemical residues in the finished product. By preserving biodiversity, enhancing soil structure, conserving water, and lowering greenhouse gas emissions, these methods help to create healthier ecosystems. With the help of certification programs, farmer education, and regulatory incentives, the demand from consumers for safe, chemical-free food is propelling the adoption of these practices. Organic and residue-free farming

can address the global issues of resource depletion, climate change, and food safety by fusing traditional knowledge with contemporary sustainable technologies, opening the door to a robust and wholesome food system.

Keywords: Organic farming; Residue-free food; Sustainable agriculture; Soil fertility; Biological pest control; Food safety; Environmental conservation; Agroecology.

Reproductive Biology of *Labeo gonius* (Hamilton, 1822) from the Burhi Gandak River, Bihar, India

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ABSTRACT

A study on the reproductive biology of *Labeo gonius*, a minor carp species from the Burhi Gandak River of North Bihar, was conducted from August 2022 to July 2023. A total of 120 individuals were collected and examined for maturity stages, fecundity, and gonado-somatic index (GSI). The reproductive cycle, based on gonadal maturity stages, exhibited distinct temporal phases: Stage I (Immature) during November–December, Stage II (Maturing) peaking in January–February, Stage III (Mature) dominating from March–May, Stage IV (Ripe) from June–September, and Stage V (Spent) in October. Monthly mean GSI values ranged from $2.2 \pm 0.14\%$ (October) to $23.30 \pm 1.4\%$ (July), with peak values indicating the breeding season during the monsoon months. Fecundity estimates ranged from 29,211 to 1,53,339 eggs. Conservation measures, such as regulating harvest size, monitoring overfishing, and enforcing a complete ban on capture during the breeding season, are recommended for sustainable management of this population.

Keywords: Reproductive biology, maturity stages, GSI, fecundity.

A case study on the current status of coral reefs' health on Havelock and Neil Islands of the Andaman region

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ABSTRACT

Coral is one of the important marine invertebrates that lives in a hard stony substance belonging to a large group of colourful creatures. It is a diverse and variable ecosystem on Earth. There are approximately 325 islands in the Andaman Islands and 247 islands in the Nicobar Islands. The primary objective of the study is to assess the recent ecological condition of the coral reefs on the particular islands. Deeply focusing on coral bleaching, and species intensity. Primary data were collected through field surveys, underwater visual surveys, and photographic documentation analysis were used to evaluate coral health conditions as live coral bleaching intensity in that area, and secondary data were collected from government websites, INCOIS, and ZSI. Coral reef assessment conducted using by underwater visual census via photographic and video documentation and sea surface temperature, thermal stress, pH, and other nutritional values in the water. The study focuses on live coral cover and, percentage of bleached corals. The study found horrible results decline in live coral, and most of the sites were affected due to sea surface temperature, anthropogenic disturbances, and, most importantly things unsustainable tourism pressure. Only these two important islands are compared to other islands. This case study contributes to understanding coral reef dynamics in the Indian Ocean region.

Keyword: Coral health, INCOIS, Neil Island, Havelock Island, Climate change impact, Tourism

Studies on effect of media fortified with plant growth promoting bacteria on germination of Papaya (*Carica papaya* L.) cultivar Red Lady**Shwe Zin Phyo Aung¹, Arvind Malik², Raveena³ and Monika Yadav^{4*}**^{1,2&4} *Department of Horticulture, College of Agriculture, Choudhary Charan Singh Haryana Agricultural University, Hisar*³ *Department of Floriculture and Landscaping Architecture, MHU, Karnal***ABSTRACT**

The present investigation entitled “Studies on effect of media fortified with plant growth promoting bacteria on germination of Papaya (*Carica papaya* L.) cultivar Red Lady” was carried out during 2018-19 at Centre for Quality Planting Material, CCS Haryana Agricultural University, Hisar, to find the effect of media fortification with plant growth promoting bacteria and growing condition on germination of papaya seedling. The papaya seeds were grown in sixteen different fortified media and placed under open field and polyhouse conditions. The data were recorded on days taken to seed germination, germination percentage, seed vigour index. The recorded data were subjected to statistical analysis using completely randomized design. The fortified media of Cocopeat: Vermiculite: Perlite (3:1:1) + Mac 27 + PSB- P 36 under polyhouse conditions exhibited minimum days for germination, maximum germination percentage. The fortified media of Soil: Sand: Vermicompost (1:1:1) + Mac 27 + PSB-P 36 resulted in maximum seed vigour index.

Keywords: Papaya, germination, seedling, fortification**Synergizing AI-Enabled Rehabilitation and Rural Livelihood: A Pathway to Health and Economic Sustainability****T. Karthikeyan***Department of Physiotherapy, Gurugram University, Gurugram, Haryana, India***ABSTRACT**

Artificial Intelligence (AI) has emerged as a transformative force in healthcare, with its application in medicinal rehabilitation offering innovative solutions for patient care. However, the potential of AI extends beyond clinical boundaries, particularly when integrated with rural livelihood development. This study explores the concept of AI-driven medicinal rehabilitation technology as a dual-purpose intervention—enhancing health outcomes while supporting socio-economic sustainability in rural communities. AI-assisted rehabilitation systems, such as adaptive physiotherapy devices, remote monitoring platforms, and personalized recovery algorithms, can provide effective, affordable, and accessible therapeutic care in resource-limited areas. Simultaneously, training local communities to operate, maintain, and adapt these technologies creates livelihood opportunities, fosters digital literacy, and encourages local entrepreneurship in the healthcare sector. The integration of medicinal rehabilitation with rural economic strategies has the potential to reduce healthcare disparities, lower the burden on urban hospitals, and promote community-based wellness programs. Case scenarios demonstrate that such integration leads to better recovery rates, improved employment prospects, and strengthened community resilience. The findings highlight the need for policy frameworks that encourage technology transfer, skill development, and inclusive healthcare models in rural areas. By bridging the gap between AI-based rehabilitation and rural livelihood generation, this approach offers a sustainable pathway to holistic well-being and socio-economic empowerment.

Keywords: Artificial Intelligence, Medicinal Rehabilitation, Rural Livelihood, Digital Health Technology, Community Empowerment

A study on involvement of farm women in post-harvest management activities in Deoghar district of Jharkhand**Rohan Prasad Gupta and Kalyan Ghadei and***Department of Extension Education, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi-221005***ABSTRACT**

India is the largest producer of millets, pulses, milk, jute, ginger, banana, castor oil seeds, mango, papayas, lac, lemon, limes and second largest producer of Rice, Wheat, Sugarcane, Potato, Garlic, Lentils, Groundnuts, Oranges crops (FAO, 2022) But in the other side we have lot of problems regarding the post-harvest managements. Post-harvest losses in India are a significant challenge, leading to food wastage, reduced income for farmers, and increased pressure on resources. Several factors contribute to post-harvest losses in the country. In the context of agriculture and food security, the involvement of women in post-harvest operations means that women play a significant role in tasks such as cleaning, sorting, drying, storage, processing, and marketing of agricultural products. All these operations are done by quality grains. The study was conducted in Deoghar district of Jharkhand. Two blocks, Mohanpur and Madhupur, were randomly selected, and from each block, twogram panchayats and two villages from each panchayat were chosen, making a total of eight villages. Fifteen women from each village were selected randomly, resulting in 120 women farmers for the study. For collecting the required data, a structured and semi-structured interview schedule was constructed addressing all of the objectives. Socio economic profile was taken and analyzed. Involvements of women were seen in post-harvest operations. It was found that more than 50% of farm women were involved in seed procurement, treatment, sowing, drying of grains before and after threshing, pre-storage treatment, mid storage treatment, storage structure and grains storage method. Very less farm women have knowledge of threshing machine. They use traditional method (ITKs) for storage of grains. The main constraint is lack of knowledge about management of storage insect and pest. Training programs on the use of threshing machines, proper grain storage methods, and pest management could help reduce losses.

Keywords: Food Security, Women Involvement, Knowledge, Traditional method, Constraint

Protected Cultivation Technologies: Polyhouse and Net House for Off-season Vegetable Production**Ashish Meena¹ and Manju Verma²***Department of Horticulture (Plantation, spice, medicinal and aromatic crops), College of Agriculture, Agriculture University, Jodhpur (Raj.) 342304**Department of Horticulture, College of Agriculture, Nagaur, Agriculture University, Jodhpur (Raj.)***ABSTRACT**

Protected cultivation technologies such as polyhouses and net houses have revolutionized vegetable production by enabling growers to overcome seasonal limitations and adverse climatic conditions. These structures create a controlled or semi-controlled environment that supports the year-round cultivation of high-value vegetables like tomato, capsicum, cucumber and leafy greens. This study evaluates the effectiveness of polyhouses and net houses in enhancing yield, quality and profitability of off-season vegetable production under different agro-climatic conditions. Field experiments and farmer demonstrations revealed that polyhouse-grown crops exhibited higher productivity, better fruit quality and longer harvesting periods compared to open field cultivation. Net houses proved effective in reducing pest and disease incidence, particularly for crops vulnerable to insect-vectored viruses. Microclimate regulation through temperature and humidity control in polyhouses resulted in improved plant growth and earlier flowering. Water and nutrient use efficiency was also significantly improved through drip irrigation and fertigation systems. However, wider adoption is constrained by high initial

investment and limited technical knowledge. To maximize the potential of protected cultivation, there is a need for capacity-building, government support and region-specific structure designs.

Keywords: Net House, Polyhouse, Vegetable Production

Spatial variability of soil nutrients in Miyar valley (Lahaul & Spiti) of Himachal Pradesh under different land use systems

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ABSTRACT

Miyar valley in the cold desert trans-Himalayan region of Himachal Pradesh falls under the administrative jurisdiction of the Lahaul and Spiti district and is a key agricultural area with diverse land use systems, yet its nutrient status remains poorly studied amid harsh, unpredictable climatic conditions and sparse human activity. Therefore, to understand the effects of land use systems on soil chemical properties in Miyar valley, GPS based 133 surface soil samples were collected from eight different land-use systems: cultivated lands (annual crops), cultivated lands (perennial crops), forests, orchards, pasture lands, seabuckthorn plantation, polyhouses and floriculture in the year 2023. Soil samples were analyzed for soil fertility parameters: Soil pH, organic carbon (OC), electrical conductivity (EC), available nitrogen (N), available phosphorus (P), available potassium (K) under different land use systems and compared. The investigation revealed that soil pH varied from 6.42 to 8.12 in the region, with the highest pH (7.17) recorded in cultivated lands and lowest (6.86) in forests. EC varied from 0.29 to 0.77 dSm⁻¹ which was in safe range for growing agricultural crops. The mean OC content was highest in forests (26.12 g kg⁻¹) and lowest in floriculture (9.10 g kg⁻¹). Overall, OC was high in all land use systems. Available N, P, K ranged from 120 to 340, 8 to 44, 107 to 452 kg ha⁻¹. The mean available nitrogen content was highest in seabuckthorn plantation (287 kg ha⁻¹) and lowest in floriculture (152 kg ha⁻¹). Available P was highest in the cultivated lands (perennial crops) which was 29 kg ha⁻¹ and was lowest in floriculture i.e. 16 kg ha⁻¹. Available K was highest in the forests (327 kg ha⁻¹) and lowest in floriculture (185 kg ha⁻¹). The findings of this study revealed that soil physico-chemical properties varied under different land use systems and seabuckthorn is playing a vital role in maintaining soil fertility in the Miyar region.

Keywords: Miyar valley, Lahaul & Spiti, land use systems, seabuckthorn, perennial crops, soil physico-chemical properties

Knowledge and Adoption of Potato Growers towards Post-Harvest Management Practices in Ghazipur district of Uttar Pradesh

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Department of Agricultural Extension and Communication NAI, SHUATS

ABSTRACT

The study was conducted Ghazipur district of Uttar Pradesh to assess the knowledge of potato grower towards post-harvest management practices. Total number of 120 respondents were selected purposively from 6 villages under Mardah block because productivity, production and area under potato cultivation were found to be maximum. The data were collected by interview method by using pre structured schedule and later appropriate statistical analysis was done to find out the meaningful result. The finding also revealed that majority (64.16%) of respondent have medium knowledge level followed by 19.16% of those having low and 16.68 per cent of those having high knowledge level towards improved potato post-harvest practices

Keywords: Ghazipur, post-harvest, potato

Role of Socioeconomic, Cultural, and Historical Perspectives in Road Accidents of Bihar**Kundan Raj and Amrendra Kumar***Department of Civil Engineering, Sandip University Madhubani***ABSTRACT**

Road accidents in Bihar result from a complex interaction of socioeconomic deprivation, cultural practices, and historical road-planning legacies, compounded by climate change-related hazards such as flooding and heatwaves. This paper synthesizes official accident records (NCRB/MoRTH 2018–2022), state transport department reports, and meteorological impact assessments to analyse trends in accidents, fatalities and injuries. We demonstrate that low-income populations, rural road users, and seasonal migrants bear disproportionate risk. The study highlights the need for integrated policy measures that combine infrastructure upgrades, socio-cultural interventions, and climate adaptation strategies to reduce road casualties and build transport resilience in Bihar.

Keywords: Road safety; Bihar; socioeconomic factors; cultural perspectives; historical context; climate change; transport resilience

Green and Sustainable Entrepreneurship: The Role of Eco-Innovation in Creating Circular Economy Business Models for Climate Change Mitigation**Kaushily Prakash Gupta***Department of Commerce, Sanskriti University, Chhata, Mathura, Uttar Pradesh, India***Purpose**

Climate change and environmental problems are big challenges for the planet, and traditional ways of doing business often make these issues worse by using too many resources and releasing a lot of carbon. To fix this, there is a need for new and creative business approaches that are both environmentally friendly and economically strong. Green entrepreneurship, which focuses on creating businesses that are good for the environment as well as profitable, has become an important part of sustainable development. However, there is not enough research on how eco-innovative business models can help scale up sustainable practices while still being competitive. This study looks at how green entrepreneurship affects the development of circular economy models, explores the factors that lead to the success of sustainable start-ups, and examines how eco-innovation contributes to efforts to reduce the impact of climate change.

Material and Methods

This research used a mix of quantitative and qualitative methods. The quantitative part included a survey of 350 green entrepreneurs from 15 countries, selected through stratified random sampling from the Global Green Business Network. The survey measured factors like environmental focus, innovation ability, business performance, and how well they follow circular economy practices using validated scales. The qualitative part involved in-depth case studies of 12 high-impact sustainable companies in areas like renewable energy, waste management, sustainable agriculture, and green tech. Semi-structured interviews were done with founders, key people, and experts. Financial data, environmental impact reports, and stakeholder engagement results were collected over 36 months from 2021 to 2024. Policy documents from 20 countries were analyzed to look at how supportive the regulations were. Statistical methods like multiple regression, structural equation modeling, and comparative analysis were used with SPSS and R software.

Results

The results showed that green entrepreneurs had much higher levels of eco-innovation compared to traditional ones. Circular economy models were found to be 32% more efficient with resources and 28% better at reducing carbon emissions than traditional models. Key factors for success were having

a strong environmental mission, being able to engage stakeholders, and having access to green financing. The case studies found that successful green start-ups combined three main areas: technological innovation, measuring environmental impact, and building a collaborative ecosystem. Financial analysis showed that 78% of green businesses became profitable within four years, with an average annual revenue growth of 24%. The environmental impact assessments showed that these companies reduced carbon emissions by 2.3 million tons of CO₂ equivalent. Policy analysis showed that supportive regulations boosted green entrepreneurship by 43% in the regions studied.

Conclusions

Green and sustainable entrepreneurship is a key part of moving toward circular economy models and reducing the effects of climate change. The study shows that eco-innovative approaches not only improve environmental outcomes but also maintain strong economic performance. The combination of an environmental mission, technological innovation, and stakeholder collaboration is the best way to ensure the success of sustainable ventures. These findings suggest that green entrepreneurship should be a priority in policy, education, and investment strategies to meet global sustainability goals. Future research should focus on how circular economy models can be scaled up and the long-term effects of green entrepreneurship on sustainable development.

Keywords: Green entrepreneurship, circular economy, eco-innovation, sustainability, climate change mitigation, environmental business models

Taxonomical Study of Cyanophyta in Nandurbar District of Maharashtra (India)

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ABSTRACT

The term Biodiversity refers to the totality of Genus, Species and Ecosystem of the region. Blue- green algae are among the most ubiquitous organisms on earth. The group Cyanophyta is an extremely diverse group of prokaryotic organisms which make valuable contribution to soil fertility by fixing atmospheric nitrogen. These have tremendous potential in environment management. A number of “floras” summarizing the known species of cyanophyta in particular regions have been published during the 20th centuries. Several of these provide a lot of information about species occurring elsewhere in the world. In any case it is clear that many species have a very wide distribution. For comparative account with previous work the present investigation was done. Systematic account and statistical analysis of genus and species of group cyanophyta was explored in present work. District Nandurbar from Maharashtra state, India selected for the investigation. The work was also done for seasonal variation, and addition of any new finding of species in light of biodiversity and various distribution of group Cyanophyta. In the present taxonomic survey total 40 species of group cyanophyta are reported, total 13 genera, 40 species, 02 varieties and 2 forma have been identified spread over the class Chamaesiphonales, Pluerocapsales, and Nostocales of Cyanophyta. Based on the number of taxa the dominance of algal Genera is Genus *Lyngbya* with 12 species Genus *Nostoc* with 9 species, *Spirulina* with 05 species, *Hydrocoleum* with 3 species are recorded.

Keywords: - Biodiversity, Taxonomy, Cyanophyta, Nandurbar

Optimizing Legume-Based Cropping Systems for Climate-Smart Agriculture: Enhancing Soil Health, Reducing Emissions, and Improving Energy Efficiency in South Asia

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ABSTRACT

South Asia's rice-wheat-dominated farming landscape faces growing pressure from climate variability, resource depletion, and food system vulnerabilities. This research investigates the role of legume-integrated, low-input cropping systems in advancing climate-smart agriculture (CSA) through improved environmental and energy performance. Conducted over two years across 597 agroecosystems spanning 353 hectares, the study evaluated seven diversified cropping systems against conventional tillage rice-wheat systems (Ct-RWS). Key indicators—crop productivity, greenhouse gas (GHG) emissions, energy use efficiency (EUE), water footprint, and soil health—were assessed. Notably, cropping systems such as MMG, MLG, FMG, and PG demonstrated superior energy performance, with PG requiring the lowest energy input (14,521.78 MJ ha⁻¹) and achieving the highest EUE (39.03) alongside an 83.14% reduction in CO₂-equivalent emissions. MMG recorded the highest energy output at 227,988.10 MJ ha⁻¹. Compared to Ct-RWS, these systems reduced GHG emissions by 12–65%, increased system productivity by 13–42%, and improved profitability by 65.89%. Soil health metrics revealed a 37.27% increase in organic carbon and a 7.56% rise in available nitrogen, confirming enhanced fertility and long-term sustainability. GIS-based spatial mapping enabled identification of emission hotspots and efficiency zones, supporting precision climate interventions. These results demonstrate that integrating legumes with conservation agriculture principles offers a scalable pathway toward low-carbon, climate-resilient agri-food systems in the region.

Keywords: energy use efficiency, sustainable intensification, climate resilient agriculture (CRA), net CO₂-emission, mitigating GHGs-emissions.

The Effect of Bio-inoculants on Growth, Yield and Rhizosphere Soil biology of Chilli (*Capsicum annuum* L.)

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Purpose

Chilli (*Capsicum annuum* L.) is a popular vegetable and universal spice crop belonging to the family Solanaceae. In India, chilli is consumed in various ways as vegetable, spice, pickles, sauce etc. These are important source of vitamin A, vitamin B, vitamin C and vitamin E with minerals like copper, manganese, molybdenum, potassium and thiamin etc. Now days, cultivation of crops through organic inputs are being encouraged with intensity to minimize the inorganic fertilizer use and pesticides that are hazardous to the environment. The most commonly used Biofertilizers in horticulture crops are *Azotobacter*, *Bacillus*, *Azospirillum*, and *Pseudomonas*. In the recent concept of organic farming, the use of biofertilizers (*Azotobacter*, *Azospirillum*, VAM, and PSB) plays a vital role in the nutrient management of chilli. Keeping the above fact in view the present investigation was undertaken in the year 2022-23, at Department of Agricultural Microbiology, IGKV, Raipur, with the aim to evaluate the bio inoculants effect on growth and yield performance of Chilli; simultaneously also study rhizosphere microbiology in chilli crop (Var. Mohit).

Material and methods

The experiment was carried out with Completely Randomized Design comprising of 7 treatments and 4 replications. Treatments include T1 (Control), T2 (Azoto-122), T3 (Azoto-146), T4 (Azoto-137), T5

(Azoto-122+PSB-126), T6 (Azoto-146+PSB-126) and T7 (Azoto-137+PSB-126). Plant parameters evaluated included morphological growth performances of chilli (survival (%), plant height, biomass weight, root length), shoot nitrogen content and yield attributes (number of fruits per plant, and weight of fruit per plant). Rhizosphere microbial population and enzymatic study were carried out.

Results

These *Azotobacter* and PSB strains were collected from Microbiology repository and were revitalized with concerned Jensen's and Pikovskaya's medium respectively. *Azotobacter* isolates (Azoto-122, Azoto-146 and Azoto-137) in Jensen's medium produced circular, gummy, convex, with entire margin, whitish in colour while PSB (PSB-126) isolated in Pikovskaya's agar media produced creamy to yellowish round with entire margin and, showing moderate clear zone surrounding the colony growth. Azoto-137 isolate showed positive reaction for starch hydrolysis, while positive reaction for catalase test, urease test, and oxidase test was observed for all isolates. The experimental results revealed that significantly increase in plant height from (73.00 cm) to (85.30 cm), number of fruit/plants from (19.50) to (38.00), maximum biomass weight from (40.75 g/plant) to (54.75 g/plant) were observed under the treatment T7 (Azoto-137+PSB-126) over control. Significantly highest nitrogen content in shoot (28.34mg/g dry weight of plant) were noted under T7 (Azoto-137+PSB-126) at harvest, while minimum nitrogen content was (13.65mg/g dry weight of plant) under T1 (Control). Significantly maximum yield characteristics viz. number of fruits per plant (38.00), and yield per plant (142.75g) were recorded with treatment T7 (Azoto-137+PSB-126) followed by T6 (Azoto-146+PSB-126). Treatment T7 (Azoto-137+PSB-126) and T6 (Azoto-146+PSB-126) were observed as the best treatment combinations as compared to other treatments.

Analysis of rhizosphere soil of pot grown chilli crops, significantly enhance in the *Azotobacter* population from (8.64 log₁₀ cfu/g soil) to (8.79 log₁₀ cfu/g soil), PSB population from (6.09 log₁₀ cfu/g soil) to (7.54 log₁₀ cfu/g soil), dehydrogenase activity from (2.86 µg TPF g⁻¹ soil h⁻¹) to (12.49 µg TPF g⁻¹ soil h⁻¹), phosphatase activity from (2.23µg PNP g⁻¹ soil hr⁻¹) to (15.11 µg PNP g⁻¹ soil hr⁻¹), and basal soil respiration rate from (0.55mg CO₂ /h/100g) to (1.07 mg CO₂ /h/100g) were recorded under the treatment T7 (Azoto-137+PSB-126) as compare to control.

Conclusions

It is seen that the treatment consisting of dual application of bio-inoculants (Azoto-137 + PSB-126) as seed treatment as well as in soil proved to be the most effective treatment with increase in chilli yield as well as microbial activity in rhizosphere soil region and may be adopted in chilli cultivation.

Keywords: Chilli crop, *Azotobacter*, PSB, Yield, Rhizosphere soil

Climate Change and its Impact on Organic Agriculture: Research Trend in the 21st Century

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ABSTRACT

It has become evident that since the industrial revolution, the level of greenhouse gases like methane, carbon dioxide, nitrous oxide, etc in the atmosphere has increased rapidly resulting in climate change. This has subsequently altered global temperatures and precipitation patterns around the globe also affecting agriculture practices. Conspicuous impacts on crop production, diseases and pest as well as weed incidence dynamics are being observed especially in organic farming which might compromise sustainable agriculture. In this regard, an in-depth assessment of research trends of 21st century regarding the impacts of climate change on organic agriculture has become quite necessary. This study aims to provide a systematic and in-depth analysis of climate change and its impact on organic agriculture/farming. The exploration of bibliometric studies on the impact of climate change to

agriculture is still limited, and this forms the basis of this present investigation. Extensive data including the scientific output of researchers, country/region contributions, affiliations, author references, and thematic trends were carefully examined using the VOSviewer program (version 1.6.15). The finding in this study shows a progressive increase in the number of related published works from 2001 to 2024 with 4262 documents retrieved from the Web of Science Core Collection database. The USA contributed the most scientifically to this field, followed by People's Republic of China, Germany and India. Highly cited authors illustrate the considerable influence these scientists have had on agricultural research due to climate change consequences. This study contributes to the existing knowledge of the impact of climate change on organic agriculture and farming practices and the urgent need for concerted efforts to address the challenges posed by climate change.

Keywords: Organic Agriculture; Climate Change; 21st Century; Bibliometric; Web of Science

Technological Advancements of Drone-Based Applications versus Conventional Practices in Orchard Crop Management: A Comparative Analysis

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ABSTRACT

Technological advancements in drone-based applications have brought a transformative shift in orchard crop management when compared to conventional practices. This research presents a comparative analysis focusing on how drones enhance precision, efficiency, and sustainability in orchard farming relative to traditional methods. Such connectivity allows proactive interventions through predictive analytics, enabling farmers to address irrigation, fertilization, and pest control more efficiently than traditional blanket applications.

Conventional orchard management typically involves manual labor-intensive tasks and ground equipment for spraying and monitoring, which are time-consuming and less precise. Traditional methods often result in higher chemical input, increased environmental footprint, and slower response times to pest or nutrient issues. In contrast, drone technology dramatically reduces the time to collect field data and apply treatments, thus enhancing operational efficiency. This level of precision reduces chemical usage by up to 49%, minimizes environmental impact such as soil and water contamination, and curtails labor requirements by 30-50%, which collectively improve profitability and crop yield stability.

This study aims to provide a comprehensive evaluation of drone technology's impact on orchard crop yield, resource efficiency, environmental sustainability, and economic outcomes in comparison to conventional practices.

Keywords: Drone spraying, Pesticide deposition, Rocker spraying, Orchard, India

Integrated Pest and Disease Management in High-Value Horticultural Crops

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ABSTRACT

High-value horticultural crops such as fruits, vegetables, spices and ornamentals are highly susceptible to a wide range of pests and diseases that can cause significant economic losses and reduce market quality. Conventional reliance on chemical pesticides has raised concerns regarding environmental safety, pesticide resistance and residue hazards. Integrated Pest and Disease Management (IPDM) offers an eco-friendly, economically viable and sustainable approach by combining multiple control strategies. In recent advancements in IPDM for high-value horticultural crops, emphasizing the integration of

cultural, biological, mechanical and chemical methods. It includes the use of resistant varieties, optimized planting practices, biological control agents such as *Trichoderma spp.*, *Bacillus subtilis* and beneficial insects, as well as need-based application of safer pesticides. The incorporation of pheromone traps, sticky traps and disease forecasting models further enhances management efficiency. Case studies from fruit orchards protected vegetable cultivation and spice plantations demonstrate the effectiveness of IPDM in reducing pest incidence, improving yield quality and minimizing chemical input. Adoption of IPDM not only supports sustainable production but also enhances the export potential of horticultural produce by meeting stringent quality standards. The study concludes that widespread adoption of IPDM, supported by farmer training and policy incentives, is essential for ensuring the profitability and sustainability of high-value horticulture under changing climatic conditions.

Keywords: IPDM, Horticulture, Sustainable Agriculture, Biological Control, Pest Management and Disease Resistance.

In vitro evaluation of fungicides and phytoextracts to manage Dry Root Rot incited by *Macrophomina phaseolina* (Tassi) Goid in Sesame

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ABSTRACT

Dry root rot, caused by *Macrophomina phaseolina* (Tassi) Goid., is a major constraint in sesame cultivation, leading to substantial yield losses under warm and dry conditions. The present *in vitro* study evaluated nine fungicides—Carbendazim 50% WP, Mancozeb 75% WP, Thiram 80% WP, Captan 70% + Mancozeb 63% WP, Thiophanate-methyl, Azoxystrobin, Captan 70% + Hexaconazole 5% WP, Pyraclostrobin 13.3% + Epoxiconazole 5% SE, and Captan 70% WP—at 25, 50, 100, and 200 ppm using the poisoned food technique. Additionally, eight phytoextracts—neem (*Azadirachta indica*) leaf, garlic (*Allium sativum*), aloe vera (*Aloe barbadensis*), bougainvillea (*Bougainvillea spectabilis*), neem kernel extract, giloy (*Tinospora cordifolia*), turmeric (*Curcuma longa*), and datura (*Datura stramonium*)—were tested at 5, 10, and 15% concentrations. Among fungicides, Carbendazim 50% WP + Mancozeb 75% WP exhibited maximum mycelial growth inhibition, followed by Carbendazim alone. Among phytoextracts, garlic extract at 15% concentration showed the highest inhibition, outperforming other botanicals tested. These results indicate that Carbendazim + Mancozeb and garlic extract possess strong antifungal activity against *M. phaseolina* and can be incorporated into integrated disease management strategies for sustainable control of dry root rot in sesame. Further *in vivo* evaluation under field conditions are also being done for its confirmatory result in large scale and natural environment interaction.

Keywords: Dry Root Rot, Fungicides and Vitro Evaluation

Spatiotemporal urban growth and climate vulnerability in Jaipur city of Rajasthan, India
Tauseef Ahmad¹ and Saurabh Kumar Gupta²¹*School of Computer Science Engineering, Sandip University, Sijoul, Madhubani, India*²*Centre for Climate Change & Water Research, SGVU, Jaipur, India***ABSTRACT**

Jaipur as a major attraction for tourism in India has undergone rapid and unprecedented urban expansion over the past decade and represents severe climatic changes. The leap frog urban growth in Jaipur has intensified challenges related to urban planning, environmental sustainability, and resource management which has further compounded by the escalating impacts of climate change. Rising temperatures, increased frequency of extreme weather events, and shifting rainfall patterns are exacerbating the environmental vulnerabilities of expanding urban regions. In this study, we present a quantitative assessment of the spatiotemporal dynamics of urban growth in the Jaipur metropolitan area from 2015 to 2023. Leveraging the computational capabilities of Google Earth Engine, Landsat 8 and 9 surface reflectance imagery were analyzed using a dual-index approach that integrates the Normalized Difference Built-up Index (NDBI) and the Normalized Difference Vegetation Index (NDVI). This method enables accurate discrimination between impervious surfaces, vegetation, and bare soil. The study reveals that urbanized area expanded by approximately 280.68 km² with increase of 11.36% highlighting significant growth corridors, particularly along the periphery of city. The research provides data-driven insights for sustainable urban planning and climate adaptation in Jaipur but also offers a replicable methodology for monitoring urbanization in other climate-sensitive, rapidly developing cities.

Keywords: Urban Growth, Climate change, Temperature, Rainfall, Jaipur**Role of Organic Amendments in Improving Soil Fertility****Omprakash Gurjar¹ and Abhitej Singh Shekhawat²***Department of Soil Science & Agricultural Chemistry, College of Agriculture, Agriculture University, Jodhpur (Raj.) 342304***ABSTRACT**

Organic amendments play a crucial role in enhancing soil fertility by improving its physical, chemical and biological properties. Materials such as farmyard manure, compost, green manures, crop residues and biochar enrich the soil with essential macro and micro-nutrients while increasing organic matter content. These amendments improve soil structure, water- holding capacity and cation exchange capacity, leading to better nutrient retention and reduced leaching losses. Moreover, they stimulate beneficial microbial activity, enhance enzymatic processes and promote nutrient mineralization, thereby making nutrients more available to plants. Long-term application of organic amendments not only replenishes soil nutrients but also contributes to carbon sequestration, mitigating the effects of climate change. Studies have shown that integrating organic amendments with balanced chemical fertilizers results in higher crop yields, improved nutrient use efficiency and sustained soil health. Therefore, the adoption of organic amendment practices is a vital component of sustainable agricultural systems, ensuring both environmental conservation and enhanced agricultural productivity.

Keywords: Organic Matter, Compost, Biochar, Nutrient Cycling, Soil Health and Sustainable Agriculture.

Innovations In English Language Learning and Teaching**Surinder Sangwan***Department of English, Pt NRS Govt College, Rohtak, Maharishi Dayanand University***ABSTRACT**

The rapid technological breakthroughs and the changing demands of global communication have completely changed the way that English is taught and learned. In order to improve language acquisition, this study examines new developments that combine learner-centered methodologies, pedagogical techniques, and digital resources. Artificial intelligence-driven learning platforms, augmented and virtual reality settings, gamified apps, and adaptive learning systems that tailor education are important areas of innovation. The usefulness of pedagogical innovations including task-based language instruction, the flipped classroom model, and content and language integrated learning (CLIL) in encouraging student participation and real-world communication skills is investigated.

The study also highlights the role of collaborative global learning networks and innovative assessment methods in promoting intercultural competence and autonomous learning. Benefits such as increased learner motivation, flexibility, and real-world contextualization are weighed against challenges including the digital divide, teacher preparedness, and potential over-reliance on technology. The findings suggest that sustainable adoption of these innovations requires balanced integration of technology with sound pedagogy, comprehensive teacher training, and equitable access to resources. This research contributes to the growing discourse on modernizing English language education to meet the linguistic and cultural needs of 21st-century learners.

Keywords: English language learning, teaching innovations, technology-enhanced learning, pedagogy, adaptive learning, gamification

Optimized Production and Characterization of Biochar from Litchi Pruned Biomass**Sanjay Kumar¹, Shashanka K N², S K Patel¹, Subhash Chandra¹ and Shailesh Kumar***^{1,2}Department of FMPE, CAET, RPCAU, Pusa, Bihar (848125), India***ABSTRACT**

Biochar, a porous carbonaceous material, is produced through dry carbonization, pyrolysis, or gasification of biomass. Crop residues and agricultural by-products serve as key feedstocks for bioenergy (producer gas, syngas, and bio-oil) and biochar production. This study optimized pyrolysis parameters for biochar production from litchi pruned biomass using Response Surface Methodology (RSM) in Design Expert-13. Four variables (heating rate, temperature, retention time, and branch-to-leaf ratio) were evaluated for their effects on biochar yield and quality attributes. A total of 29 experimental runs were conducted. The average yield was 27.03%, with mean values of moisture content (29.06%), volatile matter (29.06%), ash (7.80%), fixed carbon (57.99%), pH (9.26), electrical conductivity (1.28 dS m⁻¹), available potassium (0.082%), organic carbon (32.43%), and available nitrogen (0.028%). Statistical analysis identified temperature and retention time as the most influential factors, with moderate effects from heating rate and branch-to-leaf ratio. Optimal conditions: heating rate 5.90 °C min⁻¹, temperature 450°C, retention time 1 h, and branch-to-leaf ratio 0.5 which had a desirability index of 0.618.

Keywords: Biochar, Litchi pruned biomass, Pyrolysis, Response Surface Methodology (RSM), Optimization, and Biochar characterization.

Bacterial Biofertilizers: A Strategy for Integrated Plant Nutrient Systems (IPNS)**Renu Gupta**

SS& AC, FOA, SKUAST-Jammu

Introduction

Sustainable agriculture aims to meet the growing food demand while minimizing environmental degradation. Integrated Plant Nutrient Systems (IPNS) represent a holistic approach to nutrient management in agriculture, which integrates organic, inorganic, and biological components to improve soil health, optimize nutrient use, and increase crop productivity. One of the crucial biological components of IPNS is the use of bacterial biofertilizers. Bacterial biofertilizers offer a promising solution to improve soil fertility, enhance plant growth, and reduce dependence on chemical fertilizers. This strategy aligns with sustainable farming practices and enhances soil health, nutrient cycling, and overall farm productivity.

The Role of Bacterial Biofertilizers in IPNS

Bacterial biofertilizers are microbial inoculants that enhance soil fertility and plant growth. These microorganisms play vital roles in improving nutrient availability, promoting plant growth, suppressing plant diseases, and contributing to soil health. In IPNS, bacterial biofertilizers complement chemical fertilizers and organic amendments by improving nutrient use efficiency and promoting sustainable farming practices.

1. Nitrogen Fixation: Enhancing Soil Nitrogen

Nitrogen is one of the most essential nutrients required by plants for growth, but it is often present in limited quantities in soil. Synthetic nitrogen fertilizers, though effective, are costly and contribute to environmental pollution through nutrient leaching and greenhouse gas emissions. The use of nitrogen-fixing bacteria in IPNS helps reduce the need for chemical fertilizers and supports sustainable nutrient management.

Certain bacteria, such as *Rhizobium*, *Azotobacter*, and *Azospirillum*, have the ability to fix atmospheric nitrogen into biologically available forms, such as ammonium or nitrate, which plants can utilize. *Rhizobium*, for example, forms symbiotic relationships with leguminous plants, converting nitrogen from the atmosphere into ammonia, which can be absorbed by the plant. On the other hand, free-living nitrogen-fixing bacteria like *Azotobacter* and *Azospirillum* contribute to nitrogen fixation in non-leguminous plants.

This biological nitrogen fixation (BNF) reduces the need for chemical nitrogen fertilizers, thereby lowering input costs and minimizing environmental pollution. In the context of IPNS, the integration of nitrogen-fixing bacteria helps maintain soil fertility and promote long-term sustainability by improving nitrogen cycling in the soil.

2. Phosphorus Solubilization: Enhancing Phosphorus Availability

Phosphorus is another essential nutrient that plays a vital role in plant metabolism, root development, and energy transfer. However, a large proportion of phosphorus in soil is in insoluble forms that are unavailable to plants. To address this challenge, phosphorus-solubilizing bacteria (PSB) play a crucial role in converting insoluble phosphorus compounds into soluble forms that plants can absorb.

Bacteria like *Bacillus*, *Pseudomonas*, and *Penicillium* are known to produce organic acids such as citric and gluconic acid, which dissolve phosphorus bound in soil minerals, thereby making it available to plants. PSB not only improve phosphorus availability but also help enhance the efficiency of phosphorus fertilizers when used in combination with these microorganisms.

In an IPNS framework, phosphorus solubilizing bacteria help optimize the use of phosphorus fertilizers and reduce their environmental impact. By decreasing the dependency on chemical phosphorus inputs, bacterial biofertilizers contribute to both economic and environmental sustainability.

3. Degradation of Organic Matter and Nutrient Cycling

The decomposition of organic matter in the soil is vital for releasing essential nutrients and improving soil fertility. Bacterial species like *Bacillus*, *Pseudomonas*, and *Lactobacillus* play a key role in breaking down organic residues into simpler compounds, which are then utilized by plants. This process is particularly important for recycling nutrients such as carbon, nitrogen, and phosphorus in the soil.

The use of bacterial biofertilizers accelerates the decomposition process and improves the mineralization of organic matter, thereby enhancing the nutrient availability to plants. These bacteria also produce enzymes like cellulases, proteases, and lipases, which break down complex organic compounds into simpler forms that are more readily absorbed by plants.

Incorporating these bacteria into IPNS ensures that organic amendments, such as compost or manure, are more effective at enhancing soil fertility and nutrient availability. The improved nutrient cycling reduces the need for synthetic fertilizers and promotes more sustainable agricultural practices.

4. Plant Growth Promotion and Disease Suppression

In addition to enhancing nutrient availability, many bacterial biofertilizers also promote plant growth directly. Some bacterial species produce phytohormones, such as auxins, gibberellins, and cytokinins, which stimulate plant growth, improve root development, and enhance stress tolerance. *Azospirillum*, for example, is known for producing auxins, which promote root growth and improve nutrient uptake efficiency.

Bacterial biofertilizers can also suppress plant diseases through mechanisms like the production of antimicrobial compounds, competition for nutrients and space, and the induction of systemic resistance in plants. Beneficial bacteria such as *Bacillus* spp. and *Pseudomonas* spp. produce antibiotics, enzymes, and volatile compounds that inhibit the growth of harmful pathogens, thereby reducing the need for chemical pesticides.

By integrating plant growth-promoting and disease-suppressing bacteria into the IPNS approach, farmers can reduce their reliance on chemical inputs, improve crop health, and increase overall yield.

Benefits of Using Bacterial Biofertilizers in IPNS

The integration of bacterial biofertilizers into the IPNS framework offers numerous benefits for sustainable agriculture.

Reduced Dependency on Chemical Fertilizers: By enhancing nutrient availability through biological processes such as nitrogen fixation and phosphorus solubilization, bacterial biofertilizers reduce the need for chemical fertilizers, thereby lowering costs for farmers and minimizing the environmental impact associated with their use.

Improved Soil Health: Bacterial biofertilizers contribute to soil health by promoting nutrient cycling, enhancing microbial diversity, and improving soil structure. The decomposition of organic matter by bacteria enriches the soil with essential nutrients and organic matter, which enhances its water retention capacity and overall fertility.

Environmental Sustainability: By reducing the need for synthetic fertilizers and pesticides, bacterial biofertilizers help decrease nutrient runoff, pollution, and greenhouse gas emissions. This makes them an environmentally friendly alternative that supports sustainable farming practices.

Enhanced Crop Productivity: The synergistic effect of bacterial biofertilizers, when used alongside organic and chemical fertilizers, leads to improved crop productivity. These biofertilizers promote better nutrient uptake, root development, and stress tolerance, resulting in healthier, more productive crops.

Disease Management: The use of disease-suppressing bacteria in IPNS helps protect crops from harmful pathogens without the need for chemical pesticides. This not only improves crop yield but also contributes to the reduction of pesticide residue in the environment.

Conclusion

Bacterial biofertilizers play an integral role in Integrated Plant Nutrient Systems (IPNS) by enhancing nutrient availability, promoting plant growth, improving soil health, and reducing the need for chemical fertilizers. By incorporating nitrogen-fixing, phosphorus-solubilizing, and growth-promoting bacteria

into sustainable farming practices, farmers can reduce input costs, increase crop productivity, and contribute to environmental sustainability.

The integration of bacterial biofertilizers into IPNS is a promising strategy for achieving sustainable agriculture, enhancing food security, and ensuring long-term soil fertility. By optimizing the use of both biological and chemical components, IPNS ensures a balanced, environmentally friendly approach to nutrient management, supporting the needs of both farmers and the planet.

Comparative Performance of Different Pomegranate Cultivars for Quality Wine Production

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ABSTRACT

Pomogranate (*Punica granatum*) having rich in anti-oxidant, anti-viral and anti-tumor antimicrobial, anticancer properties with good amount of vitamin A, C and E and folic acid, and higher phenolic content for body defense, pomograntae wines are healthier then red wines. Hence conducted an experiment on ‘Comparative performance of different pomegranate cultivars for quality wine production’ at Vasantrao Naik of College of Agricultural Biotechnology, Yavatmal. The four different cultivars of pomegranate viz., Bhagwa, Bhagwa super, Ganesha and Ruby were screened for wine production with the yeast *Saccharomyces cerevisiae*. The 5% yeast inoculum was added as starter culture to collected juice samples in different flasks and placed for fermentation. Racking was done 3 to 4 times at weekly interval during fermentation period. After final racking the wines were clarified again by adding 400 mg/lit. Bentonite clay (0.1%) and kept samples undisturbed for four days. Physiochemical properties of wine viz., pH, TSS, titrable acidity, alcohol content, reducing sugar, non reducing sugar, total sugar and ascorbic acid were analyzed from all wine samples during ageing after 30 days of fermentation. The organoleptic evaluation of wine samples were undertaken for overall acceptability using 20 points Hedonic scale. Among all the four varieties, the variety Bhagwa scored maximum points 14.59 followe by Bhagwa super, Ganesha and Ruby for overall acceptability and recorded the highest contents of TSS, titrable acidity, reducing sugar, non-reducing sugar, total sugar and alcohol and thus found most suitable for winery among all the four tested varieties.

Keywords: Pomogranate cultivars, Bhagwa, Bhagwa super, Ganesha, Ruby, yeast, Organoleptic test, wine.

Assesment of Different Ph Levels for Production of Quality Wine from Nagpur Mandarin

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ABSTRACT

A wine production study was carried out at Vasantrao Naik College of Agricultural Biotechnology, Yavatmal. The conducted experiment entitled “Assesment of different pH levels on production of quality wine from Nagpur mandarin”. using yeast *Saccharomyces cerevisiae*” Fruit juice extracted from Nagpur Mandarin was taken for the physicochemical analysis to prepare wine at five different levels of pH that is pH 3.0, 3.5, 4.0, 4.5 and 5.0 to get quality wine at optimum pH. All the juice samples adjusted at 25°B and placed at 20 °C to 22°C. Must juice samples were subjected to fermentation by adding 5% yeast inoculum of the *Saccharomyces cerevisiae*. After 30 days of fermentation, it was observed that the pH, of wines were found gradually decreased along with reduction in TSS, titrable acidity, ascorbic acid, and reducing sugar with increased in alcohol content of wine. The must pH 4.5 gave the maximum pH (4.2) i.e. less acidic wine. At the same pH the wine produced contained the maximum total soluble solids, minimum reducing sugar, maximum total sugar and alcohol. The organoleptic evaluation of

wine, reported that Nagpur Mandarin wine prepared at pH 4.5, scored 8.03 points for overall acceptability categorized as like very much wine and thus found acceptable for winery. Wine prepared at pH level 4.0 stood next to pH 4.5 with preferable TSS, titrable acidity, ascorbic acid, reducing sugar, alcohol content and organoleptic score 7.88, categorized as like moderately wine.

Keywords: Nagpur mandarin, yeast, pH, wine

Characterization of Phosphate Solubilizing Bacteria for Nodulation in Chickpea

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Dr. Panjabrao Deshmukh Krishi Vidyapeeth Akola

ABSTRACT

Phosphorus is a vital but least mobile element in plants and soil as compared to other macronutrients. Native phosphate solubilizing bacterial strains were isolated from the rhizosphere of different crops. Based on *in vitro* study, the isolate showed lower pH, remarkable phosphate solubilizing index, and thermotolerant ability selected for further morphological, biochemical and molecular characterization. The 16s rRNA sequencing of the isolates PSB1, PSB2, PSB 4, showed high similarity 99.34%, 99.38%, 99.15% with *Bacillus velezensis*. PSB 5, PSB 6, PSB 8 showed high similarity 99.72%, 99.52%, 100% with *Bacillus amyloliquefaciens*, *Brevibacillus brevis*, *Bacillus subtilis* respectively based on nucleotide homology analysis. In field trial experiment with eight different treatments the results of co-inoculation with (*Rhizobium* + *PSB1*) showed superior result over all the treatment. Co-inoculation of (*Rhizobium* + *PSB1*) shows not only significant enhancement in nodulation, nodule fresh weight but also yield attributes and phosphorous contain in seed as compared to check (*Rhizobium* + *Bacillus megaterium* 8755) indicating its potential and role in phosphorus nutrition in chickpea. The results infer that the native *PSB1* could be considered as a proficient biofertilizer in the organic farming system.

Keywords: Bacteria, Chickpea, Nodulation, Phosphorous, Solubilization

Elicitors efficacy against necrotic pathogen Alternaria leaf spot of soybean

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ABSTRACT

The Field trial was conducted during Kharif season for two consecutive years (July–October 2017 and 2018) at three different locations namely; Amravati, Yavatmal and Katol under Dr. Panjabrao Deshmukh Krishi Vidyapeeth., Akola, Maharashtra, India. The nine treatments were designed in randomized block design replicated thrice to determine the potential use of an elicitor for *Alternaria* leaf spot management compared with standard fungicide. The treatments include two foliar sprays of either abiotic elicitors alone namely Salicylic acid (SA) @ 100 ppm, Benzoic acid @ 100 ppm, Humic acid @ 1%, Jasmonic acid @ 100 ppm, Potassium nitrate (KNO₃) @ 1% or biotic elicitors *Trichoderma viride* @ 1%, *Pseudomonas fluorescens* @ 1% alone or recommended fungicide Propiconazole 0.1% alone at crop flower initiation stage and at 60 days after sowing. Field trials results shows the Propiconazole 0.1% significantly superior in management of disease upto 44.72 % followed by Jasmonic acid @ 100 ppm in controlling the disease upto 40.01 % and was found at par with propiconazole 0.1% in respect to percent disease index, percent disease control and seed yield. Highest percent disease index and least percent disease control and yield recorded in control. Elicitor Jasmonic acids induce protective, therapeutic treatments reduced the severity of disease advocated suppressing necrotrophic pathogen *Alternaria alternata*, the eco-friendly alternatives to fungicides

Keyword: *Alternaria*, efficacy, elicitors, fungicide, soybean

Genotype × Environment Interaction and Phenotypic Stability for Yield and Quality in Coloured Pericarp Sorghum**R. R. Dhutmal, A. W. More and Ajay Neela***Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani 431 402 (MS), India***ABSTRACT**

A multi-environment evaluation was conducted to assess the stability of grain yield, yield-attributing traits, and grain quality parameters in coloured pericarp rabi sorghum (*Sorghum bicolor* (L.) Moench). The study was undertaken at three locations—Parbhani, Basmath, and Nanded—using 21 genotypes (18 germplasm lines and 3 checks) in a randomized block design with two replications. Pooled analysis of variance indicated highly significant effects of genotype, environment, and environment + (genotype × environment) for most traits, suggesting substantial variability and genotype-specific responses to environmental changes. The significant proportion of G × E (linear) variation (67%) revealed that a major share of interaction effects was predictable. Genotype GP 1539 and RIL 40818-3-1 were identified as early flowering (63 days), whereas RIL 40141-1 (89 days) and ICRISAT 409 (83 days) were late. Early maturity was observed in GP 1539 (108 days), RIL 40818-3-1 (110 days), and GP 2017-5 (110 days), while late maturity occurred in ICRISAT 409 (129 days), Bajra type (132 days), and RIL 40141-1 (135 days). Tall plant height was recorded in GP 40053-1-2 (281 cm) and Parbhani Moti (239 cm). IS 23891, ISSVT 102, and GP 40053-1-2 were superior for panicle traits, test weight, and grain yield per plant. Quality assessment revealed Bajra type (3.377) as fully vitreous, GP 920 (9.2) with hardest grains, and ISSVT 712 (5.8) and GD 62417 (5.8) as firm. Maximum bulk density was recorded in YPT 1021, GP 40053-1-2, M 35-1, and Parbhani Moti (1.295–1.300 g/ml³), while highest porosity was in GP 40053-1-2 (32.5%), IS 23891 (30.5%), and RIL 40141 (28.5%).

Keywords: Coloured pericarp sorghum, Genotype × environment interaction, Stability analysis, Grain quality traits, multi-environment trials.

Mitigating Terminal Heat Stress in Chickpea: Role of Foliar Application at Critical Growth Stages**R. R. Dhutmal, A. G. Wankhede and A. W. More***Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani-431 402 (MS), India***ABSTRACT**

A field experiment was conducted during rabi 2022–23 to assess the impact of heat stress on chickpea and its mitigation through exogenous application of chemicals at different growth stages. The study was laid out in a split-split plot design with two replications and 48 treatment combinations, comprising two sowing dates [normal (3 November 2022) and late (22 December 2022)], eight chemical treatments [salicylic acid @ 400 ppm, salicylic acid @ 800 ppm, ascorbic acid @ 10 ppm, KCl @ 1%, thiourea @ 400 ppm, cycocel @ 1000 ppm, and KNO₃ @ 0.3%], and three stages of application (vegetative, anthesis, and vegetative + anthesis). Significant interactions were observed for several growth and yield parameters. The sowing date × chemical treatment interaction significantly influenced plant height, days to 50% flowering, pods per plant, unfilled pods per plant, seeds per pod, 1000-seed weight, seed yield per plant, and harvest index. The sowing date × stage of application interaction affected days to 50% flowering, seed yield per plant, and harvest index, while the chemical treatment × stage of application interaction significantly influenced most measured traits. Triple interaction effects were significant for plant height, phenology, yield attributes, and seed yield. The treatment combination D1T5S3 (normal sowing + thiourea @ 400 ppm + vegetative and anthesis stage) recorded superior performance for plant height, yield attributes, and seed yield, while D1T2S3 (normal sowing + salicylic acid @ 800 ppm + vegetative and anthesis stage) excelled in pods per plant, seeds per pod, 1000-seed weight, and harvest

index. The results demonstrate that timely sowing combined with targeted chemical applications, particularly thiourea and salicylic acid at dual growth stages, can effectively mitigate terminal heat stress and improve chickpea productivity under changing climatic conditions.

Keywords: Terminal heat stress, Chickpea (*Cicer arietinum* L.), Exogenous chemical application, Sowing time, Yield and physiological traits

Unravelling the nutritional and functional attributes of chickpea protein

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ABSTRACT

The global demand for alternative proteins has increased tremendously in the past decade. The conversion losses that occur during the conversion of plant protein to animal protein make them unsustainable. In contrast, proteins from plant sources are sustainable, good for health, especially when mixed with other plant proteins, and free from the concern of zoonosis. Hence, the plant-based protein market has seen unprecedented expansion in the past few years. Soybean, pea, wheat, and hemp protein are some of the plant-based proteins available in the market. Besides this, chickpea protein is the new option that is getting popular because, unlike soybean and wheat, it has no allergens and does not have a beany flavour. India is the major producer and consumer of chickpeas. Chickpea protein has the potential to reduce the burden of protein malnutrition in our country. Characterisation of chickpea protein is essential to elucidate and improve its nutritional and functional properties. In this study, we have extracted chickpea protein isolates from chickpea flour and from processed chickpeas (soaking, germination, malting & microgreens) using the alkaline extraction (pH 9)-isoelectric precipitation (pH 4.5) method. Among all the sources, the highest protein recovery was obtained from chickpea flour (41.54%), while the lowest was from cooked chickpeas and chickpea microgreens. The chickpea protein was characterised using FTIR spectroscopy, and the deconvolution of the amide I region (1634-1638 cm^{-1}) was done to determine the secondary structures. The SDS-PAGE analysis showed the predominant 11S legumin and the minor 7S vicilin bands in all samples except cooking, where a smear was seen. Next, this study will focus on the nutritional and functional attributes of chickpea protein from raw and germinated chickpeas.

Keywords: Chickpea, Nutritional and functional

Growth, Flowering and Flower Yield of African Marigold cv. Pusa Narangi Gaiinda as influenced by Integrated Nutrient Management (INM)

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ABSTRACT

An investigation was carried out to study the combined effect of inorganic, organic and bio-fertilizers on vegetative growth, flowering and flower yield of Marigold (*Tagetes erecta* L.) cv. Pusa Narangi Gaiinda at the Experimental Field, Department of Horticulture, Udai Pratap (Autonomous) College, Varanasi during the year 2021-2022. The experiment was conducted in randomized block design (RBD) with three replications and seven treatment combinations comprising of RDF (NPK), FYM, Vermicompost and Bio-fertilizers viz. Azotobacter. All the treatment combinations showed significant response in vegetative, flowering and yield parameters during entire investigation. The treatment combinations i.e. T₃ 75% RDF + 25% Vermicompost@1.25t/ha + Azotobacter @5kg/ha showed

maximum plant height (79.82 cm), number of primary and secondary branches/plant (13.50 and 30.58), number of leaves/plant (207.68) and stem diameter (2.76 cm), days to first bud initiation (30.09 days), days to first flowering (40.16 days) and 50% flowering (55.01 days) and also number of flower/plant (33.32), flowering duration (45.13 days), fresh weight of flower (8.75 g), flower yield/plant (311.41 g), and flower yield/hectare (15.37 t). The maximum shelf life of flower (6.78 days) was found in the treatment T₅ (50% RDF + 50% Vermicompost @2.5t/ha + Azotobacter@5kg/ha). Among all the treatments, T₃ was recorded maximum net return and highest benefit cost ratio *i.e.* Rs. 4,71,425.00 and 3.28.

Keywords: Marigold, RDF, FYM, Vermicompost, Azotobacter, Shelf life.

Metabolic Responses of Chickpea to Heat Stress: Role of Phenolics and Phytosterols

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ABSTRACT

Chickpea, a staple food legume in India, faces significant productivity threats due to rising global temperatures and prolonged heat stress. In response to thermal stress, chickpea plants undergo physiological and biochemical adjustments, including shifts in gene expression and metabolite profiles, to enhance heat resilience. Among the critical compounds involved in stress defence are phenolics and phytosterols. They are key secondary metabolites with protective roles. This investigation assessed the physiological (relative water content and membrane stability index) and biochemical responses (total antioxidant capacity, phenolic and phytosterol composition) in leaves of chickpea genotypes subjected to high-temperature conditions at the flowering stage. Analytical data showed that heat stress elevated the total phenolics, flavonoids, and antioxidant activity, while reducing relative water content and membrane stability index. Phenolic composition analysis indicated a significant accumulation of syringic acid, sinapic acid, catechin hydrate, and myricetin under stress, with a notable decline in gallic acid. Furthermore, heat exposure enhanced the β -sitosterol and stigmasterol content across most of the chickpea genotypes. The results refine our understanding of chickpea's metabolic and physiological plasticity under heat stress and offer valuable indicators for breeding thermotolerant cultivars.

Keywords: Heat stress, Phenolics, Phytosterols

Prospects of Peach (*Prunus persica* L.) Cultivation in Bihar Under Changing Climatic Conditions

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ABSTRACT

Peach (*Prunus persica* L.), which has traditionally been cultivated in temperate regions, is now gaining prominence in the agroclimatic zones of Bihar due to the development of several low-chilling cultivars. Climate change, evidenced by rising temperatures, irregular rainfall patterns, and inconsistent chilling hours, presents significant challenges to sustainable peach production in the region. This study assesses the adaptability and performance of selected low-chill peach varieties under the subtropical conditions of Bihar, focusing particularly on their phenological responses, fruit quality, and yield stability in the

face of changing climatic trends. The focus is on climate-resilient orchard management practices, including updated planting schedules, protective irrigation methods, and integrated pest and disease management strategies. Peach farming in Bihar has strong potential as a profitable horticultural venture, especially with the right varietal selection and adaptive interventions. This can contribute to crop diversification and improve farmer livelihoods in the face of climate variability.

Keywords: *Prunus persica*, climate change, phenology, crop diversification, quality, Yield.

Ethno-botanical importance of various weeds found in Boudh locality and their current status
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ABSTRACT

Various types of weeds found in different areas of the Boudh locality, such as roadside areas, grasslands, crop field margins, home gardens, open fields, and forest land. These weeds possess numerous medicinal properties and are traditionally used by local people and healers. This study was conducted to assess and document the medicinal properties of various weeds found across different locations of Boudh district during the period from August 2023 to February 2024.

The exploration revealed folk use of 51 species of weed plants belonging to 26 families for the treatment of various ailments. Indigenous knowledge from local traditional healers on native weed plants used for medicinal purposes was collected. In this study, the most dominant family was Asteraceae, and leaves were the most frequently used plant parts for treating of various diseases. A majority of the species were used to cure dermatological conditions. The local population, primarily comprising tribal communities, often depends on forest flora for their livelihood and uses certain weeds as herbal medicines for prevention and treatment of ailments and diseases. Most of the weeds are known to possess therapeutic properties, and the associated traditional knowledge has been passed down orally through generations. These plants offer medicinal benefits with minimal or no side effects. However, many of these species are now threatened and gradually disappearing from society due to a lack of proper knowledge, documentation, and conservation efforts.

Keywords: Ethno-medicinal importance, weeds, Boudh, traditional knowledge, current status

From Newsrooms to Newsfeeds: A Comparative Study of Media Influence, Framing Strategies and Public Climate Change Awareness
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ABSTRACT

Climate change is still one of the most important problems in the world in the 21st century, but people in different countries, civilisations, and political systems have very different levels of knowledge, comprehension, and involvement. I intend to know further about this subject because I need to know how traditional and digital media sort through climate change news. The media not only shape what people know, but they also shape what people think and do. This study looks at how the media's influence on climate change awareness is growing across platforms, framing strategies, and audiences. This is done because talking about climate change may bring people together or tear them apart. The study came to its results by looking at real-world research from 1988 to 2024.

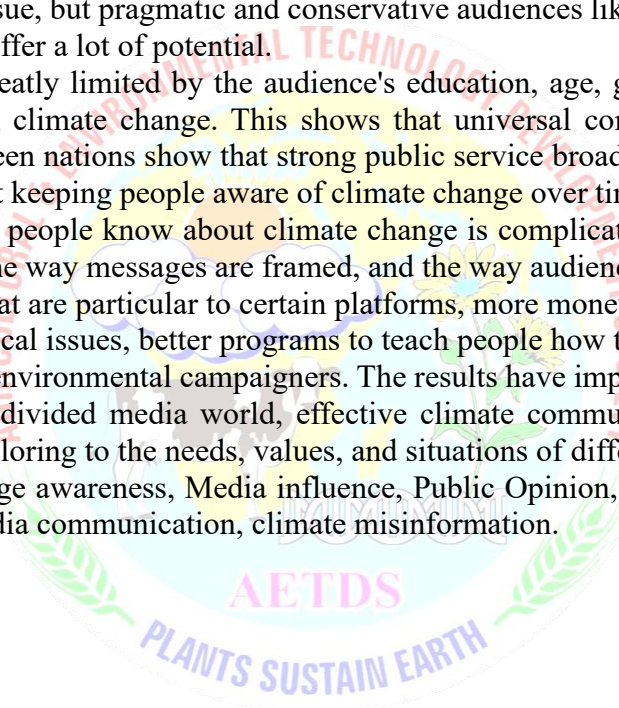
This study used scholarly articles that had been peer-reviewed, reports from institutions, and international surveys. This overview contains audience research based on surveys, experimental framing studies, cross-cultural studies that compare different cultures, and quantitative assessments of news and digital media content. The sources from environmental communication research, media

studies, political science, sociology, and psychology come together to form a multi-theoretical synthesis based on the theories of agenda-setting, framing, cultivation, and social learning. The Mixed Methods Appraisal Tool was used to look at just high-quality empirical research for this review. The figures reveal that media coverage and influence have changed a lot over the past 30 years. Traditional print media has stopped using "false balance" reporting and started using risk-focused and economic-benefit framing that is in line with what science says.

In particular, frames of uncertainty are less essential. Limited and sporadic TV coverage, mostly during major weather occurrences or political anniversaries, makes it hard for the public to understand. YouTube and Instagram's instructional depth and visual storytelling are the biggest differences between the two digital platforms. They help people learn about climate change. Because of algorithmic moderation and echo chambers, Facebook and Twitter don't always get the same results. Exposure to several channels enhances awareness, however the consequences differ depending on the group and their beliefs. How you say something affects how people react. Even though they appeal to people with different political views, health co-benefit frameworks are not used enough. Localised risk frames make people feel closer to the issue, but pragmatic and conservative audiences like economic-benefit frames. Health co-benefit frames offer a lot of potential.

The media's effects are greatly limited by the audience's education, age, gender, political views, and personal experiences with climate change. This shows that universal communication doesn't work. Comparative studies between nations show that strong public service broadcasting and other structural media systems are better at keeping people aware of climate change over time. This review reveals that the media's effect on what people know about climate change is complicated. This effect comes from the way platforms work, the way messages are framed, and the way audiences are grouped. The results include climate projects that are particular to certain platforms, more money going into messaging that is focused on health and local issues, better programs to teach people how to spot fake news, and other credible messengers than environmental campaigners. The results have important effects on policy and practice. In a digital and divided media world, effective climate communication demands accurate information and careful tailoring to the needs, values, and situations of different audiences.

Keywords: Climate Change awareness, Media influence, Public Opinion, Environmental journalism, framing effects, social media communication, climate misinformation.



Climate Resilient Farming (CRF): Pulses in the Cauvery Delta

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ABSTRACT

The Cauvery delta zone, a vital agricultural hub in Tamil Nadu, is known for its fertile alluvial soils and diverse cropping systems. However, the region is increasingly vulnerable to climate variability, including erratic rainfall, rising temperatures, and water scarcity. This heavy reliance on irrigation makes the area susceptible to droughts and unpredictable monsoon patterns, which negatively impact crop yields, particularly for pulses. To address these challenges, climate resilient farming (CRF) strategies are being implemented, with the cultivation of pulses serving as a key component. Pulses like green gram, black gram, cowpea and pigeon pea are a sustainable choice due to their drought tolerance, market value, and soil-eco adaptation. These strategies play a crucial role in pulse farming of the delta zone by drought-resistant varieties, strategic sowing (at present cultivar, sowing period selection), and optimized water and soil health management accompanied by organic farming. When following these adaptive strategies into the CRF framework, pulse cultivation can help mitigate the impacts of climate change, enhance farmer resilience, and promote sustainable agricultural development. This approach not only boosts environmental sustainability but also ensures socio-economic stability in the Cauvery delta zone.

Keywords: Cauvery delta, Erratic rainfall, Drought, Pulses, Yield loss.

Effect of seed priming methods on Black gram (*Vigna mungo* L) seed germination diversity

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ABSTRACT

Black gram is not only a highly nutritious legume but also an essential crop with cultural and economic significance. The production of black gram is less due to poor germination. So, the experiment was conducted to enhance the germination of it by using of different priming agent and to find the impact of different priming agent on *Black gram*. The experiment was laid out in Completely Randomized Design replicated thrice using Hydropriming, *Aloe vera*, Moringa, CaCl₂(1%), MgCl₂(1%), NaCl (1%) and non-priming (control). The primed and unprimed seed were planted in tray, where individual

treatment poses 20 seeds. The germination characteristics (germination energy, speed of germination vigor index I and II) and growth attributes were studied. The data were organized in MS excel 2010 and analysed through Gen-stat ver. 2018 Mean separation was done by DMRT at 5% level of significance. The result depicted that priming with aloe vera and hydropriming (distilled water) significantly affected the germination parameters and seedling characteristics. The aloe vera priming showed highest germination energy, germination index, germination speed & vigor index II 93.3, 46.7, 8.67, & 24.43 respectively followed by hydropriming and least by CaCl_2 . Using of botanical extract like aloe vera was found important priming agent for enhancing the black gram germination parameter.

Keywords: Botanical extract, priming, germination, Black gram, seedling

An Integrated Approach to Managing Leaf Blight Disease of Mustard (*Alternaria* spp.) in the Kosi Region of Bihar

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ABSTRACT

Mustard (*Brassica juncea* L.) is a vital oilseed crop cultivated extensively in the Kosi region of Bihar, covering the districts of Purnea, Katihar, Araria, Supaul, and Kishanganj. The region's humid subtropical climate and fertile alluvial soils create ideal conditions for mustard cultivation, but these same factors also favour the proliferation of several devastating diseases. Among the major diseases, *Alternaria* blight, White rust, Downy mildew, and Turnip mosaic virus collectively cause 30–60% yield losses, severely impacting farmer livelihoods and regional oilseed production. Current management practices rely heavily on chemical fungicides, which are often unsustainable for smallholder farmers and raise environmental and economic concerns. A particularly severe threat is posed by Leaf blight, caused by *Alternaria brassicae* and *A. brassicicola*. This disease significantly reduces yield and seed quality. Symptoms include necrotic, target like lesions with concentric rings and chlorotic halos, predominantly appearing on older leaves near the soil surface. The disease is favoured by high humidity (~95% RH), moderate temperatures (20–30 °C), and prolonged leaf wetness, conditions that prevail in the Kosi region during the mustard-growing season. Pathogen survival is facilitated through microsclerotia and chlamydospores persisting in crop residues and soil, enabling repeated seasonal epidemics. Farmers frequently face recurrent epidemics of *Alternaria* blight and White rust, compounded by the lack of resistant varieties, over-reliance on fungicides, and the region's conducive microclimate. Importantly, there is an absence of region specific Integrated Disease Management (IDM) modules, resulting in low yields and poor oil quality. For the humid, rainfall prone conditions of the Kosi region, a holistic IDM approach offers the most sustainable solution. This includes cultural practices like Crop residue management, timely sowing, and field sanitation. Biological control agents application of *Trichoderma harzianum* and *Pseudomonas fluorescens*. Botanical elicitors extracts of neem and garlic for reducing pathogen load and targeted sprays using tebuconazole-based combinations or mancozeb-mixed regimes during critical crop stages. Implementation of this integrated strategy can effectively suppress *Alternaria* inoculum, enhance yield and oil quality, and minimize dependence on high dose chemicals. Such an approach aligns with farmer adoption feasibility and promotes environmental safety and economic viability for sustainable mustard production in the region.

Keywords: Mustard, Kosi region, *Alternaria* blight, Management

Climate-Resilient Urban Infrastructure: Research Analysis**Hemant Kumar Thakur and Rahul Kumar***Department of Civil Engineering, Sandip University, Sijoul, Madhubani, Bihar, India***ABSTRACT**

This paper provides research examination of climate-resilient urban infrastructure. In times of accelerating climate change, cities are increasingly threatened by extreme weather, rising sea levels, and other hazards driven by climate. This research integrates findings from international case studies and published literature to examine the key aspects of urban infrastructure resilience. Through the analysis of policy frameworks, engineering designs, phased implementation approaches, and green infrastructure measures, the paper suggests an integrative framework for strengthening urban resilience. From the findings, it is evident that resilient climatic conditions depend on inclusive partnerships, evidence-driven policymaking, and the combination of nature-based and cutting-edge technological solutions. The study also identifies the need for harmonization of infrastructure design with financing needs and public sector power. The paper ends with suggestions for urban planners and policymakers responsible for building infrastructures resilient to climate extremes but supportive of sustainable urban growth.

Keywords: Climate change, infrastructure resilience, smart cities, adaptation strategies, disaster risk reduction, sustainable urban planning.

Circular Economy of Dark Fermentation and Phototrophic Biomethanation**Pratibha Kulkarni***Osmania University microbiology dept Alumni Hyderabad Telangana***ABSTRACT**

Biomethanation offers a sustainable route for converting carbon dioxide (CO₂), a major greenhouse gas, into methane under ambient conditions using methanogenic archaea. These archaea require minimal energy and operational input. However, observations of domestic kitchen wastewater in open canals reveal the rapid proliferation of photosynthetic purple non-sulphur bacteria (PNSB), which not only impart a distinct purple coloration but also exhibit enhanced photodriven biomethanation capabilities — outperforming traditional methanogens in methane production.

PNSB are metabolically versatile, capable of oxidizing a wide variety of organic compounds including lignocellulose, sugars, glycerol, and short-chain organic acids. They use light energy to generate reducing power, driving CO₂ reduction to methane and biological nitrogen fixation through the nitrogenase enzyme. This approach enables solar-powered bioenergy production, positioning it as a promising new route for solar energy storage and low-input methane synthesis.

In addition to biomethane, PNSB contribute significantly to circular economy strategies by offering multiple value-added byproducts such as single-cell protein, biofertilizers, bioplastics, carotenoids, coenzyme Q10, and pantothenic acid. Their resilience in diverse and saline waste streams enhances their potential in wastewater treatment, climate-resilient agriculture, and bioresource recovery.

This phototrophic system presents a compelling case for integrated waste-to-value solutions, linking wastewater treatment, bioenergy production, and agricultural sustainability.

Keywords: Economy, Dark Fermentation and Phototrophic Biomethanation

Teak Based Agroforestry Systems at Farmers Field**Rakesh Bajpai, S.B. Agrawal and S. Sarvade***Department of Forestry, College of Agriculture, Jabalpur- 482004, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur (MP), India***ABSTRACT**

A field investigation was conducted during 2021-22 to evaluate the productivity and economic performance of teak-based agroforestry systems at selected farmers' fields in Umariya, Panagar, Shahpura, and Bargi villages. The study encompassed four system types: teak-wheat (2 ha), teak sole with vermicompost production (5 ha), teak-ginger (10 ha), and tissue culture teak sole plantations (10 ha). Conventional teak was planted at 5.0 m × 2.0 m spacing in agroforestry systems, while tissue culture teak was established in block plantations at 2.0 m × 2.0 m. Teak volume yield recorded was 4.2 m³/ha in teak-wheat, 5.3 m³/ha in teak sole with vermicompost, and 3.1 m³/ha in teak-ginger systems. Tissue culture teak plantations outperformed local teak blocks, producing 5.7 m³/ha at 3 years of age compared to 3.3 m³/ha in local teak. Economic analysis revealed net monetary returns of ₹44,405/ha, ₹5,02,500/ha, and ₹98,500/ha for teak-wheat, teak sole with vermicompost, and teak-ginger systems, respectively. Results highlight that block plantations, particularly of tissue culture teak, demonstrate higher tree productivity, and that both tree volume and profitability increase markedly with plantation age from 3 to 7 years. These findings reinforce the potential of teak-based agroforestry as a profitable land-use strategy for diversified income generation.

Keywords: Teak-based agroforestry, tissue culture, block plantation, vermicompost integration, tree volume, net monetary returns.

Robotic Solutions for Crop Monitoring and Harvesting – Future directions and Challenges**Mohd Ashaq***Department of Botany, Govt Degree College Thannamandi, District Rajouri Jammu and Kashmir, India***ABSTRACT**

The use of robotics and automation in agriculture has the potential to revolutionize crop monitoring and harvesting. Robotic systems equipped with sensors, computer vision, and machine learning algorithms can autonomously navigate fields, collect data on crop health, detect pests and disease, and selectively harvest crops at optimal ripeness with high efficiency and minimal damage. The present study explores the current state-of-the-art agricultural robotic technologies for monitoring and harvesting various crops and key considerations in robot design, sensing technologies, and algorithms. Case studies are presented showcasing robotic solutions developed for high-value crops and the impact on productivity, resource utilization, and crop quality. Future directions and challenges in widespread adoption of robotic technologies in agriculture especially in poverty stricken and rural farming ecosystem are also examined in the study.

Keywords: Agricultural Robotics, Autonomous Systems, Precision Agriculture, Computer Vision, Crop Monitoring

Phytochemical Profiling of Wild Edible Cherry of Western Himalayas: *Prunus cerasoides* D.Don and *Prunus tomentosa* Thunb.**Moamenla Jamir, A. R. Malik, P. A. Sofi, Tahir Mushtaq, Amerjeet Singh, Peerzada Ishtiyak Ahmad and Sabira Nissar***Division of Forest Products and Utilization, Faculty of Forestry, SKUAST-Kashmir, Benhama, Ganderbal, Jammu and Kashmir, India, 191201.***ABSTRACT**

Wild edible fruits are recognized as valuable sources of nutrients, rich in natural antioxidants, and widely employed in traditional medicine. To scientifically validate their ethno-medicinal claims, an experiment was conducted to understand the metabolic profiling of the species during 2024–25 at the Division of Forest Products and Utilization, Faculty of Forestry, SKUAST-K. The study evaluated both phytochemical attributes and physicochemical parameters of *Prunus* species from temperate Himalaya using different solvents—ethanol, methanol, and aqueous extracts. The bioassay results the confirmation of carbohydrates, proteins, alkaloids, tannins, sterols, saponins, flavonoids, phenols, and terpenoids, in the fruit pulp of wild cherries (*Prunus cerasoides* and *Prunus tomentosa*). The mean values of physicochemical characteristics viz., fruit length (12.23 mm), fruit thickness (14.75 mm), fruit fresh weight (2.03g), fruit dry weight (0.54g), pulp recovery (69.16%), moisture content on dry basis (320.07%), moisture content on wet basis (76.19%), total soluble solids (11.76 %) were recorded for *Prunus cerasoides* while for *Prunus tomentosa*, the mean values were fruit length (7.62mm), fruit thickness (6.90mm), fruit fresh weight (0.35g), fruit dry weight (0.14g), pulp recovery (51.23%), moisture content on dry basis (143.34%), moisture content on wet basis (58.89%), total soluble solids (21.14 %). The results concludes that the presence of a diverse range of bioactive compounds, along with notable variations in physicochemical attributes, indicating their potential therapeutic significance. This comprehensive analysis supports the development of novel drug formulations and provides scientific evidence for traditional healthcare uses. The study emphasizes the need to bridge the gap between indigenous medicinal knowledge and systematic metabolite characterization to fully establish the medicinal potential of these species for societal benefit.

Keywords: *Prunus cerasoides*, *Prunus tomentosa*, Wild fruits, Phytochemistry, Physicochemical parameters, Healthcare, Medicinal knowledge

Climate Smart Life and Living**Kalyan Ghadei¹, Virendra Kamalvanshi², Divya Katiyar³ and Chaitali Karmakar⁴**^{1,3&4}*Department of Extension Education,*²*Department of Agricultural Economics, IAS, Banaras Hindu University, Varanasi-221005 (U.P), India***ABSTRACT**

Climate change constitutes one of the most pressing global challenges, with profound implications for ecosystems, economies, and human well-being. *Climate Smart Life & Living* examines adaptive and sustainable lifestyle strategies that align with the UN Sustainable Development Goals (SDGs) and 2050 net-zero targets, emphasizing the integration of local innovation, behavioral change, and community participation into global climate action frameworks. The presentation addresses the disproportionate vulnerabilities of women and children stemming from dependence on natural resources, heightened livelihood burdens, and limited adaptive capacity while critically analyzing the structural inequalities that limit their participation in governance, policy, and planning. Core principles of climate-smart living are explored, including the 3Rs (Reduce, Reuse, Recycle), energy efficiency, sustainable transport, conscious consumption, and digital substitution for physical activities. Case studies from Stanford University, IIT Madras, and PRADAN's rural programs illustrate the measurable benefits of these

approaches in reducing emissions, conserving resources, and enhancing resilience. In the academic context, the paper underscores the strategic role of higher education institutions in modeling sustainable practices, integrating climate action into curricula, and fostering student leadership in sustainability initiatives. Furthermore, it outlines the need for climate workforce development, advocating for interdisciplinary competencies that address disaster risk reduction, biodiversity conservation, sustainable resource use, and climate-conscious policy design. The session aligns with India's LiFE (Lifestyle for Environment) mission, advocating a paradigm shift from unsustainable, consumption-driven practices to mindful, deliberate resource utilization. By synthesizing policy, education, and community engagement, *Climate Smart Life & Living* proposes actionable, evidence-based pathways for building climate-resilient societies. The approach is grounded in science, enriched by tradition, and directed toward transformative, inclusive climate action.

Keywords: Climate-smart living, Sustainable lifestyles, Climate adaptation, Gender and climate change, Life mission.

Chitosan-Copper Nanoparticles: A Promising Approach for Improving Soybean Productivity

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ABSTRACT

Soybean (*Glycine max* L.) is a vital leguminous crop recognized for its productivity is increasingly constrained by biotic and abiotic stressors. Conventional approaches to mitigate these challenges have limitations, necessitating the exploration of novel, sustainable alternatives. In the present study, chitosan-copper nanoparticles (TPP-CHT-Cu NPs) were synthesized via the ionotropic gelation method using sodium tripolyphosphate (TPP). A light blue coloration indicated successful synthesis. The nanoparticles were characterized using zeta potential, dynamic light scattering (DLS), transmission electron microscopy (TEM), X-ray diffraction (XRD), Fourier-transform infrared spectroscopy (FTIR), and energy-dispersive X-ray analysis (EDAX). The particles were spherical, polydispersed, crystalline in nature, with a size range of 150–250 nm and a zeta potential of +26.5 mV, indicating good stability. A pot experiment was conducted using various concentrations of TPP-CHT-Cu NPs (50, 75, 125, 175, 225, and 275 ppm), with water as the control. The 125-ppm concentration showed the most significant effect on plant performance. Foliar application at the vegetative stage enhanced plant height (32.61%), number of nodes (50%), leaf surface area (31.4%), number of branches (25%), root nodules (50%), fresh weight (47.21%), and dry weight (47.21%) over control. A second foliar application at the reproductive stage resulted in increased plant height (24.42%), number of nodes (38.46%), leaf area (39.45%), root nodules (37.09%), fresh weight (35.41%), and dry weight (35.41%).

Overall, two foliar applications of TPP-CHT-Cu NPs at 125 ppm significantly improved yield-related parameters: plant height (23.86%), number of branches (27.58%), average number of pods per plant (30.6%), yield per plant (34.47%), and test weight (17.9%) compared to the control. These findings highlight the potential of chitosan-copper nanoparticles as an eco-friendly and effective growth enhancer for soybean cultivation, offering a promising alternative to conventional fertilizers.

Keywords: Biodegradable, Enhancement, Plant growth, Pot, TPP-CHT-Cu NPs and Yield.

Application of Biological Chitosan-Copper Nanoparticles for Improved Soybean Plant Growth and Vigour**A.D. Savalkar, K.D. Chopkar, P.R. Shingote, D.R. Rathod, D.L. Wasule, A. M. Gaharwal and M.P. Moharil***Vasantrao Naik Government College of Agricultural Biotechnology (Dr. PDKV), Waghapur Road, Yavatmal, Maharashtra, India 445001***ABSTRACT**

Soybean (*Glycine max* L.) is an important leguminous crop known for its high protein (35–45%) and oil (18–22%) content, making it an essential source of plant-based nutrition. Day by day, instead of its worldwide importance, soybean productivity is most affected due to various biotic and abiotic factors. Because of the limitations of conventional methods for addressing these challenges, novel and sustainable approach must be investigated. The biodegradable and biocompatible biopolymer such as chitosan possess various incredible properties like promotion of plant growth, protection against photodegradation and controlled release. Copper, known for its antimicrobial activity, when combined with chitosan at the nanoscale, enhances these properties due to increased surface area and reactivity.

In the current investigation, chitosan copper nanoparticles (BIO-CHT-Cu NPs) were synthesized via biological route by using leaf extract of *Moringa oleifera* as a reducing agent. A light blue coloration showed the successful synthesis. Furthermore, the synthesized NPs were characterized by using zeta potential, dynamic light scattering (DLS), transmission electron microscopy (TEM), X-ray diffraction (XRD), Fourier-transform infrared spectroscopy (FTIR), and energy-dispersive X-ray analysis (EDAX). The particles were spherical, polydispersed, crystalline in nature, with a size range of 110–400 nm and a zeta potential of -12.8 mV, indicating good stability. The EDAX spectra showed the main elemental composition of synthesized particles such as Cu, C, O and N, which indicates the purity of sample.

A pot experiment was conducted using different concentrations of BIO-CHT-Cu NPs (75, 125, 200, 400, 600 and 700 ppm), with water as the control. The 125-ppm concentration showed the most significant effect on plant performance. Foliar application at the vegetative stage enhanced plant height (33.24%), number of nodes (50%), leaf surface area (26.93%), number of branches (14.28%), root nodules (37.5%), fresh weight (49.4%), and dry weight (49.4%) over control. A second foliar application at the reproductive stage resulted in increased plant height (28.15%), number of nodes (44.82%), leaf area (38.58%), root nodules (40.54%), fresh weight (37.1%), and dry weight (37.1%).

Overall, two foliar applications of BIO-CHT-Cu NPs at 125 ppm significantly enhanced yield-related parameters: plant height (26.78%), number of branches (30%), average number of pods per plant (30.58%), yield per plant (49.45%), and test weight (26.74%) compared to the control. These findings highlight the potential of biological chitosan-copper nanoparticles as an eco-friendly and effective growth enhancer for soybean cultivation, offering a promising alternative to conventional fertilizers.

Keywords: Alternative, Biological, Chitosan, Leaf extract and Stability.

Brown manuring for soil health, nutrient availability and enhancing productivity of kodo millets**S. B. Agrawal and S. Sarvade***Department of Forestry, College of Agriculture, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur (MP), India.***ABSTRACT**

Agriculture produce are largely transported to urban areas without counter flow of organic matter to farmer's field resulted in deterioration of soil health occur due to continuous soil mining. Kodo based cropping system covering the area of Jabalpur, Katni, Balaghat, Dindori, Rewa, Sidhi, and Shahdol

districts of Madhya Pradesh. Farmer either use very less quantity of fertilizers or no fertilizer in kodo cultivation. This practice gradually reduces both soil fertility and yield of crop. The cost of fertilizer is increasing which is not affordable to resource poor farmers. Practice of growing *Sesbania* and kodo millets simultaneously. When *Sesbania* plant overtake, weedicide applied to kill the sesbania. After spraying of 2,4D weedicide, *Sesbania* will appear brown and then died. Followed by application of *Psuedomonas* @ 10ml/lit. of water. This technology will be hampered the fungal pathogen in subsequent crops. Result of studies showed increase in the growth and yield of kodo crop and saves 25% of recommended dose of NPK, thereby improving the economical returns. Increase the soil fertility in terms of soil organic, carbon, available nutrients physical and biological properties were also observed. Suppress the weed population /growth during early stages and moisture is conserved during the practice. The technology is being practiced by resource poor in kodo growing tribal areas.

Keywords: *Conservation agriculture; brown manuring; millets; soil fertility; weedicide*

Optimizing High-Density Plantation and Canopy Management for Sustainable Productivity

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ABSTRACT

In the face of increasing global demand for food security and sustainable agricultural practices, the development of techno-receptive orchards presents a transformative approach to high-density plantation systems. This study explores innovative techniques for strategic canopy management and resource use efficiency to enhance crop yield, quality, and environmental sustainability. By integrating precision horticulture, data-driven decision-making, and advanced training systems, the research evaluates optimal spacing, pruning, and mechanization strategies to maximize light interception, nutrient uptake, and water conservation. A multi-year field study was conducted across diverse agro-climatic zones, employing remote sensing, soil moisture sensors, and physiological monitoring to assess the impact of various canopy architectures on tree productivity and ecosystem balance. Key findings indicate that optimized orchard designs can increase fruit yield by 30–40%, reduce water and nutrient wastage by 25%, and improve fruit quality parameters such as size, colour, and sugar-acid balance. Furthermore, modeling simulations reveal that adaptive canopy structures enhance photosynthetic efficiency and mitigate microclimatic stressors, contributing to long-term orchard resilience. The implications of this research extend beyond productivity gains, offering a scalable framework for climate-smart horticulture and sustainable orchard management. By fostering synergy between agrotechnology and ecological principles, techno-receptive orchards represent a pioneering shift towards resource-efficient, high-performance agricultural systems. Future research should focus on automation and AI-driven decision tools to further optimize these orchards, ensuring resilience in the face of climate variability and market demands.

Keywords: *Techno-receptive orchards; high-density plantation; canopy management; resource use efficiency; precision horticulture; environmental sustainability*

Mitigating Seed Borne Diseases in Rice Through Novel Systemic Fungicides**C. Jeyalakshmi*, T. Ramanadane, D. Shanmuga Priya and A. Kamatchi***Department of Plant Pathology, Seed Technology Research Unit, Pandit Jawaharlal Nehru College of Agriculture & Research Institute, Karaikal, U.T. of Puducherry, India.***ABSTRACT**

Experiments were conducted at Pandit Jawaharlal Nehru College of Agriculture & Research Institute, Karaikal, U.T. of Puducherry during 2021-2024 to evaluate the efficacy of novel systemic fungicide molecules including Azoxystrobin 18.2% + Difenconazole 11.4% SC (Amistar top) @ 0.05 and 0.1%, Propiconazole 13.9% + Difenconazole 13.9% EC (Taspa) @ 0.05 and 0.1%, Picoxystrobin 6.78% + Tricyclazole 20.33% SC (Galilio sensa) @ 0.1 and 0.2%, Pyraclostrobin 5% + Metiram 55% WG (Cabriotop) @ 0.1 and 0.2%, Trifloxystrobin 25% + Tebuconazole 50% WG (Nativo) @ 0.025 and 0.05 %, Difenconazole 25% EC (Score) @ @ 0.1 and 0.2%, Propiconazole 25% EC (Tilt) @ 0.05 and 0.1 %, Pyraclostrobin 10% CS (Header) @ 0.05 and 0.1 %, Tebuconazole 2% DS (Raxil) @ 0.05 and 0.1 %, Azoxystrobin 16.7% + Tricyclazole 33.3% SC (Azotrix) @ 0.075 ml and 0.15%, Tricyclazole 75% WP (Beam) @ 0.05 and 0.1 %, Fluxapyroxad 33.3% FS (Systiva) @ 0.075 ml and 0.15% and Picoxystrobin 12% + Propiconazole 7% SC (Galilio way) @ 0.1 and 0.2% against seed germination and seedling vigour of rice variety CR 1009 subl. Based on their efficacy in reducing the major seed borne pathogens and enhancing seed germination and seedling vigour, the Azoxystrobin 18.2% + Difenconazole 11.4% SC (Amistar top) @ 0.1%, Trifloxystrobin 25% + Tebuconazole 50% WG (Nativo) @ 0.05 %, Propiconazole 13.9% + Difenconazole 13.9% EC (Taspa) @ 0.05 %, Picoxystrobin 6.78% + Tricyclazole 20.33% SC (Galilio sensa) @ 0.1% were further evaluated along with the chemical check Carbendazim 50% WP @ 0.2% against seed germination, seedling vigour and seed infection under *in vitro* and seedling mortality and disease incidence under *in vivo* condition in pot culture and field emergence and found that Azoxystrobin 18.2% + Difenconazole 11.4% SC (Amistar top) @ 0.1% has recorded maximum field emergence (80%), shoot length (21.47cm) and root length (7.81cm) with minimum seedling mortality (3.3%) and without any disease incidence compared with the check (Carbendazim). The Trifloxystrobin 25% + Tebuconazole 50% WG (Nativo) @ 0.05 % ranked second in recording field emergence (80%), shoot length (16.99cm) and root length (6.79cm) with minimum seedling mortality (6.7%) and 3.3% blast incidence.

Effect of Land Use and Soil Depth on Organic Carbon and Nutrient Dynamics in Southern Karnataka**Mitali Mehta¹ and G M Devagiri²**¹*ICFRE-Rain Forest Research Institute, Sotai, Deovan, Jorhat, Assam, India.*²*University of Agricultural and Horticultural Sciences, Shivamogga, Karnataka, India.***ABSTRACT**

Soil organic carbon (SOC) serves as a fundamental indicator of soil quality, agricultural productivity and ecological resilience. Its spatial distribution and temporal dynamics are markedly influenced by land use regimes and vertical soil stratification. This investigation evaluates the effects of distinct land use systems and soil depth gradients on SOC concentrations and associated soil physicochemical properties within Southern Karnataka. This region is characterised by heterogeneous agro-ecological conditions and varied land management practices. Soil samples were systematically collected across four land use categories: block plantations, multipurpose tree species (MPTs) integrated into agricultural fields, boundary plantations, and conventional monoculture cropping systems devoid of tree cover. Sampling was conducted at four depth intervals (0–20 cm, 20–40 cm, 40–60 cm and 60–80 cm).

Quantitative assessments included SOC content and key macronutrients namely, available nitrogen (N), phosphorus (P) and potassium (K). The analysis revealed statistically significant variations in SOC and nutrient availability across both land use types and soil depths. Block plantations demonstrated superior SOC accumulation and nutrient enrichment, followed sequentially by MPT-based agroforestry systems, boundary plantations and sole cropping systems. These findings underscore the pivotal role of perennial vegetation and organic matter inputs in enhancing carbon sequestration and nutrient cycling. The study advocates for the implementation of ecologically sound land management strategies to bolster SOC stocks and sustain soil health, particularly in regions subjected to intensive agricultural exploitation. The data generated herein offer a critical foundation for the development of site-specific soil conservation frameworks and land use policies aimed at mitigating soil degradation and fostering long-term environmental sustainability.

Keywords: *Soil organic carbon; land use systems; agroforestry and sustainability*

Farmer Income Enhancement Strategies

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ABSTRACT

As farmers, we know that value repletion is most important factor for agriculture occupation while purchasing the equipment as well as other material which is farmers depend. And when they sell their crops they get low price as the result their financial condition is at crucial one so the present research paper focus on farmer income enhancement strategies which help to uplift the farmer's livelihood. We have to focus on different strategies which can help the future scholar as well as farmers who are suffering due to economical problems farmers work very hard but due to financial condition the hard work has no value in today's era so it is humble try how to focus on the crucial problem that can change life of farmer. Many farm related families already have at least one family member earning sub income away from the farm. As a farmer or farmer related family member you have to achieve farming business skills Many farmers still utilising traditional system of farming beneficial strategies which making the loss of farmers so as farmer we have to implement all the ways which can make our financial condition at upper most level. If you want to uplift the income then we have to implement proper irrigation system, increase of productivity, soil health management, farm related occupation, supplementary business, precision of fertilizers, pesticides etc. there are many strategies which will help to improve the financial condition of farmers now a days we see that farmers are commit suicide due to money they hard work but still they are living in poverty still no one thinking about their life that very bad condition of our society because who are feeding us we neglect that human. Many scholars are wrote on the issue but still the matter is on only written and implement is zero so as researcher it is my humble request to all who is related to farmer and farming come together and try to minimize the problem as our best.

Keywords: *Crucial, enhancement; implements; strategies; management; occupation; poverty*

Indigenous Livelihood Practices and their Role in Biodiversity Conservation: A Review

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ABSTRACT

India, with its diverse geographical and cultural landscapes, is home to more than 700 Scheduled Tribes (STs) recognized under the Constitution. These indigenous communities, often referred to as *Adivasis*, possess distinctive social structures, languages, and traditions, and their livelihoods are deeply

interwoven with natural ecosystems. Drawing on case studies, secondary literature, and census data, this review synthesizes the patterns of livelihood among tribal communities across India, with special reference to Karnataka. Traditional occupations such as fishing, hunting and gathering, bamboo-based handicrafts, shifting cultivation, pastoral nomadism, and the collection of non-timber forest products (NTFPs) continue to form the backbone of tribal economies, although increasing migration and wage labour are evident due to socio-economic and environmental pressures. The analysis highlights the intrinsic role of tribes in biodiversity conservation through sacred groves, totemic beliefs, agroecological practices, and sustainable harvesting methods, exemplified by community-specific practices like the *Lipum* fishing technique of the Adi and Galo tribes, rotational honey collection by the Soligas, and buffalo conservation by the Todas. However, challenges such as land alienation, displacement due to development projects, low literacy rates, and climate change threaten both livelihoods and traditional conservation systems. The review further integrates findings from empirical studies conducted in different regions, which reveal that agriculture remains the predominant livelihood source, complemented by forest-based and wage-based activities. Historical movements, notably the Bishnoi resistance of 1730, underscore the deep cultural roots of tribal environmental ethics. The paper concludes by emphasizing the need for policy frameworks that secure tribal land rights, enhance access to education and financial services, and incorporate indigenous ecological knowledge into formal biodiversity management strategies, thereby ensuring the sustainability of both tribal livelihoods and the ecosystems they protect.

Bio-Cultural Significance and Plant Diversity in the Backyards of Halakki Vokkaliga Tribes

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ABSTRACT

The present study (2022–23) investigated the bio-cultural significance, relative frequency, and relative density of backyard plant diversity among the Halakki Vokkaliga tribes in Ankola and Kumta talukas of Uttara Kannada district, Karnataka. A purposive random sample of 120 respondents (60 from each taluka) was selected, and data were collected through a semi-structured interview schedule. Species diversity was assessed using Simpson's and Shannon-Wiener indices. Kumta recorded higher diversity (Simpson's Diversity Index: 0.842; Shannon-Wiener Index: 2.936) than Ankola (0.790; 2.239), attributed to greater species variety despite smaller backyard size. Relative frequency analysis revealed that *Crossandra infundibuliformis* (5.42%) dominated ornamentals, *Trichosanthes cucumerina* (2.31%) vegetables, *Cocos nucifera* (6.80%) plantation crops, *Ocimum sanctum* (7.61%) medicinal plants, and *Laurus nobilis* (1.38%) spices. High relative density was observed for *Crossandra infundibuliformis* (36.71%), *Basella rubra* (10.83%), *Coriandrum sativum* (17.27%), and *Ocimum sanctum* (1.93%). The prevalence of these species was linked to economic returns from selling flowers, vegetables, and plantation crops, alongside household utility and cultural practices. Bio-cultural significance assessment revealed that basil (*Ocimum sanctum*) was revered by 92.50% of respondents as a sign of wealth and health, while banyan (*Ficus benghalensis*) was viewed as a symbol of life and fertility (65.00%). Peepal (*Ficus religiosa*), neem (*Azadirachta indica*), coconut (*Cocos nucifera*), bilva patre (*Aegle marmelos*), lotus (*Nehumbo nucifera*), crown flower (*Calotropis gigantea*), and shami (*Prosopis cineraria*) also held deep ritual value. These beliefs were closely tied to local religious festivals and household worship traditions. The findings highlight a strong interdependence between biodiversity conservation and cultural heritage in the Halakki Vokkaliga community. Backyard plant diversity serves multiple roles—economic support, household sustenance, and reinforcement of cultural identity. Conservation strategies

that integrate cultural values with biodiversity management could enhance both ecological resilience and the preservation of intangible heritage in indigenous communities.

Keywords: *Halakki Vokkaliga; bio-cultural significance; relative frequency; relative density; backyard biodiversity*

Optimizing Sowing Windows And Nutrient Management For Enhanced Growth And Productivity Of Greengram (*Vigna radiata* L.)

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ABSTRACT

Greengram (*Vigna radiata* L.) is a self-pollinated leguminous crop cultivated during both the *Kharif* (July-October) and Summer (March-June) seasons. It is drought-resistant and contributes to soil erosion prevention due to its deep roots and effective ground cover. Recently, the growth and yield of greengram have been adversely affected by the non-adoption of optimal agronomic practices and low soil fertility. Therefore, the timing of sowing and nutrient balance are crucial components for enhancing crop yields. Planting time constitutes a critical non-monetary factor in realizing the yield potential of improved crop varieties, as it facilitates optimal synchronization between the vegetative and reproductive phases of the crop (Kumar *et al.*, 2016). Indiscriminate application of inorganic fertilizers leads to multi-nutrient deficiencies, thereby reducing yield (Sahoo *et al.*, 2024). Foliar application of nutrients is found to be more effective as it is directly applied to the site of metabolism, allowing for immediate absorption of nutrients (Behera *et al.*, 2024). Thus, it is essential to determine the appropriate sowing date and employ a balanced and efficient fertilizer application strategy, integrating inorganic, organic, and biofertilizers along with foliar application, to achieve higher yields (Sahoo *et al.*, 2025). In light of these considerations, this study was designed to assess the effects of various treatments on the growth and productivity of greengram.

Materials and Methods

A field experiment was conducted in summer season of 2022-23 and 2023-24 at Agronomy Farm, Institute of Agricultural Sciences, BHU, Varanasi (UP). The treatments consisted of four sowing windows for greengram D₁: 1st Sowing (8th March and 14th March), D₂: 2nd Sowing (15th March and 21st March), D₃: 3rd Sowing (22nd March and 28th March), D₄: 4th Sowing (29th March and 4th April) in 2022-23 and 2023-24, respectively and five nutrient management N₁: 100% RDF, N₂: 70% RDF+ 15% RDN through Poultry manure + Consortia of biofertilizers, N₃: 70% RDF+ 15% RDN through Poultry manure + *Panchagavya* @ 30 ml L⁻¹ (2-spray), N₄: 70% RDF+ 15% RDN through Poultry manure + Seaweed extract @ 2 ml L⁻¹ (2-spray), N₅: 70% RDF+15% RDN through Poultry manure + Consortia of biofertilizers + *Panchagavya* @ 30 ml L⁻¹ & Seaweed extract @ 2 ml L⁻¹ both as tank mix (2-spray) thereby making twenty treatment combinations were tested in split plot design with three replications. The RDF for greengram (cv. HUM-16) was 15, 40, 20 kg NPK ha⁻¹, respectively.

Results:

The data concerning the growth parameters and grain yield, as influenced by sowing windows and nutrient management, are presented in Table 1. A significant variation was observed in plant height, primary branches per plant and grain yield among the different treatments. Among the sowing windows, growth parameters such as plant height, primary branches per plant and grain yield were observed higher from 8th March and 14th March sown crop over two consecutive years. Whereas, the least values were obtained from 29th March and 4th April sown crop.

Furthermore, the results indicated that among the nutrient management practices, the application of 70% RDF+15% RDN through Poultry manure + Consortia of biofertilizers + *Panchagavya* @ 30 ml L⁻¹ &

Seaweed extract @ 2 ml L⁻¹ both as tank mix (2-spray) significantly enhanced plant height, primary branches per plant and grain yield. Conversely, the application of 100% RDF yielded the lowest values during the respective years.

Table 1. Effect of sowing windows and nutrient management on growth parameters and grain yield of greengram

Treatments	Plant height (cm)		Primary branches plant ⁻¹		Grain yield (q ha ⁻¹)	
	At harvest		At harvest			
	2022-23	2023-24	2022-23	2023-24	2022-23	2023-24
Sowing windows						
D ₁ : 1 st Sowing	41.3	42.4	5.60	5.74	9.82	9.98
D ₂ : 2 nd Sowing	39.7	40.8	5.46	5.60	9.07	9.21
D ₃ : 3 rd Sowing	38.3	39.1	5.08	5.20	8.31	8.40
D ₄ : 4 th Sowing	36.2	37.1	4.74	4.82	7.40	7.50
SEm±	0.76	0.79	0.12	0.14	0.18	0.19
LSD (P≤0.05)	2.63	2.75	0.41	0.47	0.63	0.68
Nutrient management						
N ₁ : 100% RDF	37.3	38.2	4.68	4.78	7.93	8.01
N ₂ : 70% RDF + 15% RDN- Poultry manure + Consortia of biofertilizers	38.4	39.3	5.13	5.23	8.46	8.57
N ₃ : 70% RDF + 15% RDN- Poultry manure + <i>Panchagavya</i> @ 30 ml lit ⁻¹ (2-spray)	39.6	40.5	5.43	5.58	8.74	8.90
N ₄ : 70% RDF + 15% RDN- Poultry manure + Seaweed extract @ 2 ml lit ⁻¹ (2-spray)	39.0	40.1	5.28	5.35	8.70	8.81
N ₅ : 70% RDF + 15% RDN- Poultry manure + Consortia of biofertilizers + <i>Panchagavya</i> @ 30 ml lit ⁻¹ & Seaweed extract @ 2 ml lit ⁻¹ both as tank mix (2-spray)	40.0	41.2	5.60	5.78	9.40	9.59
SEm±	0.49	0.61	0.08	0.09	0.14	0.15
LSD (P≤0.05)	1.40	1.75	0.24	0.26	0.43	0.44

Conclusions

The findings of the experiment indicate that the timing of sowing and the implementation of nutrient management practices are crucial for achieving higher yields. Specifically, crops sown on March 8 and March 14 demonstrated superior growth parameters and yield outcomes. Regarding nutrient management, the application of 70% RDF combined with 15% RDN-poultry manure, a consortium of biofertilizers, *Panchagavya* at a concentration of 30 ml per liter, and seaweed extract at 2 ml per liter, both applied as a tank mix in two sprays, significantly enhanced the growth and productivity of greengram.

Keywords: *Growth parameters, Consortia of biofertilizers, Foliar application, Panchagavya, Seaweed extract*

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Chemical insecticides alternative for Management of major pests of groundnut

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ABSTRACT

An experiment to evaluate newer insecticides against major pests in groundnut was carried out in randomized block design with thirteen treatments and three replication on experimental farm at oilseeds research station, Latur. The observations on pest incidence and predators were recorded one day before imposing treatment and three and seven days after imposing the treatments from five randomly selected plants of each plot. Data so collected was subjected to statistical analysis and results were interpreted. Among the treatment for the control of the treatment of emamectin benzoate was found significantly superior for control of defoliator and leaf miner in groundnut and was at par with treatment of spinosad followed by Chlorantraniliprole. The highest pod yield gross and net monetary returns was recorded by the treatment of emamectin benzoate (i.e. 3121kg/ha) followed by the treatment of Spinosad, Chlorantraniliprole (2981 and 2891kg/ha) and were on par with each other. For management of defoliators and leaf miner in groundnut spraying of Emamectin benzoate (5 WSG 100g/ha) or Chlorantraniliprole 20 SC (100 ml/ha) or Profenofos 50 EC (1000 ml/ha), immediately after initiation of pest infestation is found effective, economical and safe to natural enemies compare to other chemicals under experimentation

Key words: *Groundnut; defoliators leaf miner and natural enemy*

Phytotoxicity and Bio-safety of Chemical insecticides used for management Chilli pest**Nareshkumar E.Jayewar***Vasantrao Naik Marathwada Krushi Vidyapeeth, (VNMKV), Parbhani, India.***ABSTRACT**

A field experiment was carried out at Vegetable Research Station, Farm, Marathwada Agricultural University, Parbhani, in RBD with eight treatment and three replications. Observations on phytotoxicity symptoms such as leaf injury, leaf yellowing, wilting, vein clearing, necrosis, epinasty and hyponasty during the study period on each observation plant in the field were recorded on one day before and 2, 7, 14 and 21 days after each spray. Total count of larvae and adults of predatory ladybird beetle *Coccinella spp.* were made from top, middle and bottom three leaves from total plants in the plot on one day before spray and 2, 7, 14 and 21 days after each spray. The insecticidal treatment acetamiprid 80g a.i. /ha had highest phytotoxic effect on chilli plants, this was followed by acetamiprid 40g a.i. /ha, imidacloprid 20 g a.i. /ha, Pride (acetamiprid 20g a.i. /ha), acetamiprid 20g a.i. /ha and acetamiprid 10g a.i. /ha which were very slight and can be tolerable. However the treatment of monocrotophos 200 g a.i. /ha and untreated control did not record any phytotoxic effect. In case of biosafety towards natural enemy of the pest the highest population of ladybird beetle was observed in untreated control and all the insecticidal treatments were harmful, to ladybird beetle. However, the most harmful treatments were acetamiprid 80g a.i. /ha and monocrotophos 200 g a.i. /ha in which not a single ladybird beetle was observed. These treatments were followed by Pride (acetamiprid 20g a.i. /ha), imidacloprid 20 g a.i. /ha, acetamiprid 40g a.i. /ha, acetamiprid 20g a.i. /ha and acetamiprid 10g a.i. /ha. However all the insecticidal treatments were intermediate and at par with each other.

Key words: Chilli; Phytotoxicity; bio-safety; predators and Chemical insecticides

Effect of finger millet (*Eleusine coracana* L.) varieties to different spacing in kharif**Wankhede A. U, V. P. Suryavanshi and N.E. Jayewar***College of Agriculture, Latur, VNMKV, Parbhani (MS), India.***ABSTRACT**

A field experiment was conducted during the kharif 2024 season at the Experimental Farm, Agronomy Section, College of Agriculture, Latur to study the effect of finger millet (*Eleusine coracana* L.) varieties to different spacing in kharif". The experiment was laid out in a Split Plot Design with two factors and replicated thrice. The main plot treatments consisted of three varieties: V₁ (Phule Nachani), V₂ (Phule Kasari), and V₃ (Dapoli-1), while the subplot treatments included three row spacings: S₁ (30 cm × 10 cm), S₂ (45 cm × 15 cm), and S₃ (45 cm × 20 cm). The results revealed that the variety **Dapoli-1 (V₃)** recorded the highest values for growth parameters such as number of tillers plant⁻¹ (3.12), number of leaves plant⁻¹ (45.5), dry matter production plant⁻¹ (41.2 g), mean leaf area (5.1 dm²), and leaf area index (0.99), significantly outperforming V₂ (Phule Kasari) and V₁ (Phule Nachani). The highest grain yield (1794 kg ha⁻¹) and biological yield (7858 kg ha⁻¹) and harvest index (24.13%) were also recorded under Dapoli-1 (V₃), which was significantly superior to the other varieties. However, **Phule Nachani (V₁)** recorded the tallest plants (104.4 cm), which was statistically at par with V₂ and significantly taller than V₃. Among row spacings, **S₃ (45 cm × 20 cm)** recorded the highest number of tillers plant⁻¹ (3.24), number of functional leaves plant⁻¹ (45.6), and leaf area plant⁻¹ (4.88 dm²), which was at par with S₂ (45 cm × 15 cm) and significantly superior to S₁ (30 cm × 10 cm). The tallest plants (105.4 cm) and maximum leaf area index (1.42) were recorded under S₁ (30 cm × 10 cm). However, the highest dry matter accumulation plant⁻¹ (46.8 g), grain yield (1887 kg ha⁻¹), and biological yield (8136 kg ha⁻¹) were recorded under **S₂ (45 cm × 15 cm)**, which was statistically at par with 45 cm × 20 cm (S₃) and significantly superior to 30 cm × 10 cm (S₁).

Keywords: Finger millet; row spacings; grain yield; varieties

Effect of nutrient management practices on growth and yield of fodder sorghum (*Sorghum bicolor* L.Moench)**Yewale Rutuja D., B. N. Aglave and V. P. Suryavanshi***College of Agriculture, Latur, VNMKV, Parbhani (MS), India.***ABSTRACT**

The field investigation entitled "Effect of different nutrient management practices on growth and yield of fodder sorghum (*Sorghum bicolor* L.)" was conducted during *kharif*-2024 at Experimental Farm, Agronomy Section, College of Agriculture, Latur. The experimental field was levelled and well drained. The soil of experimental plot was low in available nitrogen ($137.98 \text{ kg ha}^{-1}$), low in available phosphorous (9.65 kg ha^{-1}) high in available potassium ($1045.60 \text{ kg ha}^{-1}$) and slightly alkaline in reaction having (pH -7.35). The soil was clayey in texture which was favourable for normal growth of the crop. The experiment was laid out in Randomized Block Design with eight treatments and replicated thrice. Whereas, treatments are T1- control, T2- 100% RDF, T3- 100% RDF with Micronutrient Gr-II @ 0.5 % spray, T4-100% RDF with Urea spray @ 2 %, T5- 100 % RDF with 2 % DAP spray, T6- 75 % RDF with micronutrient grade II 0.5 % spray, T7– 75 % RDF with 2 % urea spray and T₈ – 75 % RDF with 2 % DAP spray. Full dose of P & K and half dose of N as basal & remaining half dose of N as top dressing at 30 DAS. Foliar application of Urea and DAP @ 2% and Micronutrient Grade-II @ 0.5 % at 30 DAS as per treatment. The experimental gross plot size was 5.4 x 4.5 m² and net plot size was 4.5 x 3.9 m². Sowing was done by dibbling method on 29th june, 2024 and harvested on 22th Sept., 2024. The results showed that application of 100% RDF with Urea spray @ 2 %, (T3) recorded significantly higher growth attributes *i.e.*, plant height (243.27 cm) plant⁻¹, number of functional leaves plant⁻¹ (14.10), leaf area plant⁻¹ (71.00 dm²), stem girth plant⁻¹ (8.37 cm), fresh weight per plant (1187.43 g) and yield attributes *i.e.*, maximum green fodder yield (462 q ha^{-1}), leaf : stem ratio (0.39) with higher GMR (₹ 1,15,526 ha⁻¹), NMR (₹ 64978 ha⁻¹) and B:C ratio (2.7) which was at par with 100 % RDF with Micronutrient Gr-II @ 0.5 % spray (T3).

Keywords: *Fodder sorghum; nutrient management; Growth; Yield; Green Fodder yield***Response of Sunflower (*Helianthus annuus* L.) to nano-DAP in *kharif* season****Gaikwad J. S., V. P. Suryavanshi and D. J. Patil***College of Agriculture, Latur, VNMKV, Parbhani (MS), India.***ABSTRACT**

A field experiment was conducted at Experimental Farm, Agronomy section, College of Agriculture, Latur during *kharif*, 2024 to study the response of Sunflower (*Helianthus annuus* L.) to nano-DAP in *kharif* season. The soil of experimental site was clayey in texture. The experiment was laid out in Randomized Block Design (RBD) with eight treatments replicated thrice. The treatments were T₁ - Control (No Fertilizer), T₂ - 100 % RDF, T₃ - 100 % RDF + Two spray of 2 % DAP, T₄ - 100 % RDF + Two spray of 0.4 % Nano DAP, T₅ - 75 % RDF + Two spray of 2 % DAP, T₆- 75 % RDF + Two spray of 0.4 % Nano DAP, T₇ - 75 % RDF + One spray of 2 % DAP @ 30 DAS + One spray of 0.4 % Nano DAP @ 45 DAS and T₈ - 75 % RDF + One spray of 0.4 % Nano DAP @ 30 DAS + One spray of 2 % DAP @ 45 DAS. The recommended dose of fertilizer 90:45:45 NPK kg ha⁻¹ was applied as per treatments. The result revealed that the growth and yield attributes of sunflower were influenced significantly due to the different treatments. Application of 100 % RDF + Two spray of 0.4 % Nano DAP (T₄) recorded significantly highest growth and yield attributes *viz.* plant height (199.33 cm), number of functional leaves plant⁻¹ (31.23), leaf area plant⁻¹ (63.87 dm²), stem girth plant⁻¹ (8.57 cm), head diameter plant⁻¹ (18.74 cm), dry matter accumulation plant⁻¹ (133.52 g), number of filled seeds

plant⁻¹ (972), test weight (65.81 g), seed yield plant⁻¹ (41.27 g), seed yield (2443 kg ha⁻¹), stalk yield (4895 kg ha⁻¹), oil yield (834 kg ha⁻¹), being at par with the application of 100 % RDF + Two spray of 2 % DAP (T₃) over rest of the treatments. The highest gross monetary returns (1,77,826 ₹ ha⁻¹), net monetary returns (1,22,343 ₹ ha⁻¹) and B:C ratio (3.21) was recorded with the application of 100 % RDF + Two spray of 0.4 % Nano DAP (T₄) over other treatments.

Keywords: *Sunflower; RDF; DAP; nano DAP; foliar spray*

Effect of soil and foliar application of micronutrients on growth and yield of sunflower (*Helianthus annuus* L.) during pre-rabi season

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ABSTRACT

A field trial was conducted during the pre-rabi, 2024 at Experimental Farm, Agronomy section, ATS, Latur, to evaluate the effect of soil and foliar application of micronutrients on growth and yield of sunflower (*Helianthus annuus* L.) The experimental field was laid out in a Randomized Block Design (RBD) with eight treatments replicated three times. The treatments were T₁- Control, T₂- 100 % RDF (90:45:45 kg NPK kg/ha), T₃- RDF + soil application of ZnSO₄ @ 25 Kg/ha, T₄- RDF + soil application of Borax @ 5 Kg/ha, T₅- RDF + foliar application of 0.5% ZnSO₄ at head formation, T₆- RDF + foliar application of 0.2% Borax at head formation, T₇- RDF + soil application of ZnSO₄ @ 25 Kg/ha + Borax @ 5 Kg/ha and T₈- RDF + foliar application of 0.5% ZnSO₄ + 0.2% Borax at head formation. The results depicted that the growth and yield components of sunflower were influenced significantly due to application of various treatments. The application of treatment RDF + soil application of ZnSO₄ @ 25 Kg/ha + Borax @ 5 Kg/ha (T₇) showed significantly highest growth attributes viz. plant height (202.16 cm), number of functional leaves plant⁻¹ (28.90), leaf area plant⁻¹ (61.44 dm²), total dry matter accumulation (118.34 g), stem girth plant (8.91 cm) and head diameter (19.83 cm) and was significantly superior over rest of the treatments except for T₈. Highest yield attributes viz. number of filled seeds plant⁻¹ (888), test weight (51.04 g), seed yield plant⁻¹ (48.10 g), seed yield (1974.61 kg ha⁻¹), stalk yield (3434.33 kg ha⁻¹), biological yield (5408.94 kg ha⁻¹) and harvest index (36.51 %) were recorded by the application of treatment RDF + soil application of ZnSO₄ @ 25 Kg/ha + Borax @ 5 Kg/ha (T₇). The highest GMR (140035.61 ₹/ha), NMR (88816.61 ₹/ha) and B:C (2.73) ratio was obtained with application of treatment RDF + soil application of ZnSO₄ @ 25 Kg/ha + Borax @ 5 Kg/ha (T₇).

Keywords: Sunflower; micronutrients; zinc-sulphate; borax; soil application; foliar application

Effect of pre- and post- emergence herbicides on growth and yield of soybean (*Glycine max* L.)

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ABSTRACT

The field experiment was carried out during *kharif* season of 2024 at Experimental Farm of Agronomy Section, College of Agriculture, Latur to study the response to pre and post emergence herbicides on the growth and yield of soybean. The soil was clayey in texture, low in available nitrogen (125.44 kg ha⁻¹), low in available phosphorus (9.21 kg ha⁻¹), very high in available potassium (1045.60 kg ha⁻¹) and moderately alkaline (pH 7.68) nature. The experiment was laid out in randomized block design with three replications and seven treatments. The treatments were T₁ – Pendamethalin 38.7 % CS @ 677.25 g a.i/ha (PE), T₂ – Metribuzin 70% WP @ 0.525 kg a.i/ha (PE), T₃ – Metribuzin 70% WP @ 0.525 kg a.i/ha (PoE), T₄ – Propaquizafop 2.5% + Imazethapyr 3.75% w/w ME, T₅ – Fomesafen 11.1% +

Fluazifop-butyl 11% W/W SL @ 250 g a.i /ha, T6 – Weed free (Two hand weeding) T7 – Weed check (control). The results showed that the highest plant height (56.77 cm), leaf area plant⁻¹ (6.15 dm²), dry matter plant⁻¹ (20.20 g), no. of pods plant⁻¹ (41.07), seed yield plant⁻¹ (5.05 g), seed yield ha⁻¹ (2882.24 kg) were recorded with weed free treatment (T7) which was at par with the application of Propaquizafop 2.5% + Imazethapyr 3.75% w/w ME (T4) and Fomesafen 11.1% + Fluazifop-butyl 11% W/W SL @ 250 g a.i /ha (T5). These treatments found significantly superior over the rest of treatments. However, Metribuzin 70% WP @ 0.525 kg a.i/ha (PE) (T2) and Metribuzin 70% WP @ 0.525 kg a.i/ha (PoE) (T3) exhibited moderate to severe phytotoxicity symptoms (rating 6–7), which adversely affected plant growth and resulted in lower seed yields of 829.82 kg/ha and 782.34 kg/ha, respectively.

Keywords: Weed management; Soybean Phytotoxicity; Pendamethalin; Metribuzin; Propaquizafop; Imazethapyr; Fomesafen; Fluazifop-butyl

Effect of nano urea and nano DAP on growth, yield and quality of soybean [*Glycine max* (L.) Merrill]

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ABSTRACT

A field experiment was conducted during Kharif 2024 at the Experimental Farm, Agronomy Section, College of Agriculture, Latur, to study the effect of nano urea and nano DAP on the growth, yield, and quality of soybean (*Glycine max* (L.) Merrill). The experimental soil was clayey in texture, moderately alkaline (pH 7.4), low in available nitrogen (112.9 kg ha⁻¹), medium in phosphorus (7.46 kg ha⁻¹), and high in potassium (1145.60 kg ha⁻¹), with good drainage and uniform topography. The experiment was laid out in Randomized Block Design with eight treatments replicate thrice. The treatments were T₁- Control (No fertilizer), T₂ - 100% RDF (30: 60: 30 NPK Kg ha⁻¹), T₃ - 100% RDF + two sprays of Nano Urea at 30 DAS and 45 DAS, T₄ -100% RDF + two sprays of Nano DAP at 30 DAS and 45 DAS, T₅ - 75% RDF + two sprays of Nano Urea at 30 DAS and 45 DAS, T₆ - 75% RDF + two sprays of Nano DAP at 30 DAS and 45 DAS, T₇ - 75% RDF + one spray of Nano Urea at 30 DAS and one spray of Nano DAP at 45 DAS, T₈ -75% RDF + one spray of Nano DAP at 30 DAS and one spray of Nano Urea at 45 DAS. The results revealed that application of 100% RDF + two sprays of Nano Urea @ 30 DAS and @ 45 DAS (T₃) recorded highest growth attributes viz. plant height (66.71 cm), number of functional leaves (19.43), branches per plant (9.23), leaf area (6.31 dm²), and dry matter accumulation (43.24 g). T₃ also recorded the highest yield attributes viz. number of seeds pod⁻¹ (3.1), number of seeds plant⁻¹ (173.8), Seed yield plant⁻¹ (16.57 gm), seed index (12.51), grain yield (3286 kg ha⁻¹), straw yield (5351 kg ha⁻¹), biological yield (8637 kg ha⁻¹) and harvest index (38.08%). Economic analysis also showed that application of 100% RDF + two sprays of Nano Urea @ 30 DAS and @ 45 DAS (T₃) gave the highest gross monetary returns (₹161014 ha⁻¹), net monetary returns (₹104568 ha⁻¹), and benefit-cost ratio (2.9).

Keywords: Soybean; RDF; Nano Urea; Nano DAP; foliar application

Periodical changes in Radiation Use Efficiency at Different Growth Stages on soybean**Praveen Kumar, A. M. Khobragade, M. D. Gaikwad, G. N. Gote, R. B. Mane, S. Bharade, S. Chanda***Department of Agricultural Meteorology, Vasant Rao Naik Marathwada Krishi Vidyapeeth, Parbhani, (M.S.), India.***ABSTRACT**

An experiment was conducted during *Kharif* 2024 at the Research Farm of the Department of Agricultural Meteorology, VNMKV, Parbhani to evaluate the influence of different sowing dates and soybean varieties on growth, yield and phenology. The study was laid out in a split-plot design with four sowing dates (25th SMW, 26th SMW, 27th SMW & 28th SMW) and three varieties (MAUS-158, MAUS-162, JS-335). Early sowing (D₁) significantly enhanced growth parameters, including plant height (25.06 cm), leaf area index (2.5) and dry matter accumulation (17.29 g plant⁻¹). Grain yield was highest in D₁ (1969.1 kg ha⁻¹) and decreased with delayed sowing. MAUS-158 is superior as compared to other varieties with maximum yield (1608.8 kg ha⁻¹) and use more RUE (2.40 kg MJ⁻¹) and PAR interception were highest under early sowing and in MAUS-158, indicating efficient use of thermal and radiation resources. Reflected PAR was lowest in MAUS-158, indicating efficient radiation absorption. Results highlight that early sowing in the 25th SMW with MAUS-158 optimize growth, yield, and RUE under semi-arid rainfed conditions. This study emphasizes the importance of strategic sowing time and varietal choice for maximizing soybean productivity through improved radiation and thermal resource management.

Keywords: *Soybean; PAR; Radiation use efficiency; Dates of sowing and Varieties***Growing Degree Days by different methods for Parbhani location in *rabi* Sorghum crop****R. Y. Gaikwad, G. N. Gote, A. M. Khobragade, R. B. mane***Department of Agricultural Meteorology, Vasant Rao Naik Marathwada Krishi Vidyapeeth, Parbhani, (M.S.), India.***ABSTRACT**

The present study was conducted at the research farm of the Department of Agricultural Meteorology, Vasant Rao Naik Marathwada Krishi Vidyapeeth, Parbhani, to examine the Effect of thermal regimes on *rabi* sorghum (*Sorghum bicolor*.L) varieties. The experiment followed a split-plot design with three replications. Three sowing dates were evaluated: D₁ (42nd SMW), D₂ (43rd SMW), D₃ (44th SMW). The study involved four sorghum varieties: V₁ - Dagadi, V₂ - Parbhani Moti, V₃ - Parbhani Super Moti, and V₄ - Parbhani Shakti. The crop was sown at a spacing of 45 × 15 cm, and the net plot size for each treatment was 4.5 × 2.1 m². Computation of Growing Degree Days by different methods for parbhani location in *rabi* Sorghum crop. On the basis of C.V. values of different 8 methods were examined it was found that method 1: Standard Degree Day method and method 5 : (method 1 × DL/12) was recorded the least C.V. for all the varieties across the sowing dates. Hence for further analysis of GDD method 1 : Standard Degree Day method and method 5 : (method 1 × DL/12) found suitable for Parbhani location for *rabi* sorghum crop.

The highest Growing Degree Days (GDD) was observed in first date of sowing D₁ followed by D₂ and D₃ respectively. Among the varieties highest GDD was reported Parbhani Moti followed by Parbhani Super Moti and Dagadi. Lowest total accumulate was in Parbhani Shakti.

Keyword: *Sorghum,l; Growing degree day; Varieties; Date of Sowing*

Radiation Use Efficiency and Growth Performance of Pigeon Pea (*Cajanus cajan* L.) Under Rainfed Conditions**M. D. Gaikwad, A. M. Khobragade, Praveen Kumar, G. N. Gote, M. G. Jadhav, R. B. Mane***Department of Agricultural Meteorology, Vasantao Naik Marathwada Krishi Vidyapeeth, Parbhani, (M.S.), India.***ABSTRACT**

A research experiment was conducted in *Kharif* 2024-25 at Research farm AICRP Agrometeorology, Vasantao Naik Marathwada Krishi Vidyapeeth, Parbhani to study radiation use efficiency on pigeon pea with respect to different dates of sowing and varieties during *Kharif* season. The field experiment was laid out in a split plot design with three replications. There were 12 treatment combinations comprising of four sowing dates viz., D₁ (25th SMW), D₂ (26th SMW), D₃ (27th SMW) and D₄ (28th SMW) as main plot treatments and three varieties viz., V₁ (BDN-711), V₂ (BDN-716) and V₃ (GODAVARI) as sub plot treatments. It was found that D₁ (25th SMW) gave significant results in photosynthetically active radiation (PAR), radiation use efficiency (RUE), yield and yield components which were due to efficient GDD than other dates of sowing. Similarly, variety V₂ (BDN-716) performed significantly better than V₁ (BDN-711) and V₃ (Godavari) in yield and radiation use efficiency.

The highest RUE was recorded in D₁ (4.50 kg ha⁻¹ MJ⁻¹), while the lowest value was observed in D₄ (1.46 kg ha⁻¹ MJ⁻¹). Among the varieties, V₂ (BDN-716) showed the highest RUE (4.14 kg ha⁻¹ MJ⁻¹), whereas V₃ (Godavari) recorded the lowest (3.93 kg ha⁻¹ MJ⁻¹). These findings reflect significant interactions between crop physiology, phenology and prevailing environmental conditions.

Results highlight that early sowing in the 25th SMW with BDN-716 optimize growth, yield, and RUE under semi-arid rainfed conditions. This study emphasizes the importance of strategic sowing time and varietal choice for maximizing soybean productivity through improved radiation and thermal resource management.

Keywords: Photosynthetically active radiation (PAR); Radiation use efficiency (RUE); Pigeon pea varieties; dates of sowing

Phenological studies on Pigeon pea cultivars under varied weather environment**O. R. Nagre, A. M. Khobragade, G. N. Gote and R. B. Mane***Department of Agricultural Meteorology, Vasantao Naik Marathwada Krishi Vidyapeeth, Parbhani, (M.S.), India.***ABSTRACT**

Present investigation during the academic year 2024–25, a study was conducted at the Department of Agricultural Meteorology, College of Agriculture, Vasantao Naik Marathwada Krishi Vidyapeeth, Parbhani. To investigation were, to assess the phenological studies on Pigeon pea cultivars under varied weather environment and effect of weather parameters on growth, development and yield of Pigeon pea, to prepare crop weather calendar of Pigeon pea. Long term data from 2015-2024 use for this study. Collection of data from AICRP on Agrometeorology, VNMKV, Parbhani. During this period, the mean maximum temperature reached up to 31.4 °C, while the minimum dropped to 19.0 °C. Mean annual rainfall was also variable, with the highest recorded value being 945.7 mm.

During the phenological assessment of pigeon pea, it was observed that the transition from emergence to the seedling stage required the longest duration, spanning approximately 25 to 29 days. In contrast, the shortest interval was recorded 5 to 8 days between sowing and emergence. Phenological analysis revealed that the longest duration was recorded between the branching and flowering stages, spanning approximately 69 to 77 days. Additionally, the highest mean maximum temperatures, ranging from 33.4 °C to 39.2 °C, were observed during the pod formation to grain formation stage. Correspondingly,

the highest mean minimum temperature, varying between 12.5 °C and 18.4 °C, were recorded from grain formation to physiological maturity.

In the assessment of agrometeorological indices for pigeon pea, the highest values of Growing Degree Days (GDD), Helio-Thermal Units (HTU), and Photo-Thermal Units (PTU) were recorded during the 2015-2024 cropping season, accumulating 4250.5 °C days, 25747.2 °C Day-hours, and 51005.5 °C Day-hours respectively over the span of 23 SMW to 02 SMW. Among the various sowing schedules, the early sowing date D₁ (25th SMW) recorded the maximum accumulation of thermal units, indicating its potential advantage for crop development under prevailing agroclimatic conditions.

Keywords: *Phenological stages; Pigeon pea; Cultivars & Agrometeorological indices*

Impact of Weather factors on Grey mold disease of Castor caused by *Botryotinia ricini*

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ABSTRACT

Castor (*Ricinus communis* L.), is an important non-edible oilseed crop. It contains 50-55% oil and plays a vital role in Indian vegetable oil economy. It is mainly grown in tropical and sub tropical climate. Due to the many uses of castor oil, its worldwide demand rises at an average of 3-5% per annum. Castor oil, derived from the castor seed, is unique among all other oils because it is the sole source of hydroxy fatty acid; ricinoleic acid (about 85%), conferring a lot of its distinctive industrial properties. Castor oil is widely used for many industrial products like; ointments, fiber optics, nylon, varnishes, airplane engine lubricants, hydraulic fluids, dyes, detergents, plastics, soaps, greases, paints, synthetic leather, cosmetics and perfumes. The leaves of castor are also used in sericulture as feed for eri and muga silkworms. Castor is known to suffer from many fungal and bacterial diseases at different crop growth stages. Among these, one of the most destructive diseases of castor, primarily infecting inflorescence and racemes, is gray mold, caused by the fungus, *Botryotinia ricini*. In India, the disease first occurred in Karnataka² and appeared in epidemic form during 1987 in Andhra Pradesh. The first symptoms are visible as bluish spots on the inflorescences, on both female and male (before anthesis) flowers, and on developing fruits. On fruits, the symptoms can evolve to circular or elliptic, sunken, dark coloured spots that can result in rupture of the capsule. These symptoms are usually more frequent when a period of low relative humidity unfavourable to fungal sporulation occurs soon after the fungus penetrates the host tissues. There are few studies of the epidemiological aspects of gray mold on castor mentioned that temperatures around 25°C and high relative humidity are highly favourable to disease development.

Morpho-Physiological Changes in Makhana (*Euryale ferox* Salisb) Seeds during Development

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ABSTRACT

Makhana (*Euryale ferox* Salisb.), a member of the family Nymphaeaceae and commonly known as fox nut or gorgon nut, is widely distributed in the tropical and subtropical regions of East and Southeast Asia. It thrives in lakes, ponds, reservoirs, and other shallow water bodies. The plant is notable for its

large floating leaves, which can reach up to 1.5 m in diameter. The seeds, particularly the kernel, constitute the main edible part and are rich in starch, proteins, vitamins, minerals, and other bioactive compounds. Starch, the primary storage material, accounts for approximately 70% of the seed's dry weight, and its biosynthesis and accumulation are directly linked to both yield and quality. Despite its nutritional and economic value, limited research has been conducted on the starch biosynthetic pathway in *E. ferox*, highlighting the importance of exploring this process to enhance seed quality. Phytochemical investigations have revealed that flavonoids are the principal bioactive constituents, with 129 flavonoid compounds reported in its seeds. Recent studies have expanded understanding of seed dormancy, germination traits, genetic diversity, and antioxidant activity; however, descriptions of seed developmental stages remain scarce. Documenting morphological changes during development and the concurrent accumulation of medicinally important metabolites is crucial. Secondary metabolites such as flavonoids, lignins, and alkaloids are closely associated with *E. ferox* seed development. The phenylpropanoid biosynthesis pathway, particularly involving key enzymes such as PAL and cytochrome P450, plays a pivotal role in synthesizing these metabolites. Moreover, seed development is accompanied by significant biochemical shifts, with starch serving as the primary reserve and flavonoids functioning as key bioactive molecules. The abscisic acid (ABA) signal transduction pathway is integral to regulating these physiological and biochemical changes during maturation. This study aims to elucidate the morphological, biochemical, and molecular dynamics of *E. ferox* seed development, with emphasis on starch accumulation, flavonoid biosynthesis, and ABA-mediated regulation. The findings will provide valuable insights into growth and maturation processes, offering a theoretical basis for molecular breeding and quality improvement in *E. ferox*.

Key words: *Makhana (Euryale ferox Salisb.)*; Seed Size; Secondary metabolites

A Geospatial Assessment of Environmental Indicators: LST, NDBI, NDSI, NDVI, NDWI, and LULC Dynamics in Kumaun Himalaya

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ABSTRACT

The Kumaun Himalaya region, which shares a border with the Western Himalaya, uses remote sensing, geospatial technologies, and GIS applications like Google Earth Engine (GEE), Excel, and ArcMap 10.8 platforms to measure changes in land use and land cover (LULC) and climate change indicators like land surface temperature (LST), normalized difference built-up index (NDBI), snow index (NDSI), vegetation index (NDVI), and water index (NDWI). The results show significant increases in land surface temperature between 1990 and 2020, particularly in the Greater Himalaya, where the growth rate was 137.5%. By 2050, projections indicate that the average land surface temperature will be 44.48°C. The NDBI trends show a considerable increase in urbanization, especially in the Bhabar region, which has grown at a pace of 66.67%. The Greater Himalaya has seen a 73.77% decrease in snow cover, according to NDSI statistics, indicating heightened vulnerability to climate change. NDVI trends show significant degradation in vegetation, particularly in the Siwalik (-34.31%) and Greater Himalaya (-51.02%) regions. Water stress has significantly increased, according to NDWI measures; in the Greater Himalaya, declines have reached as high as 284.72%. Significant changes have been observed in land use and land cover, with built-up areas increasing by 44% and bare terrain decreasing by 23.77% between 2017 and 2023. According to forecast models, by 2050, vegetation and water availability would be under more stress, and all evidence point to a declining trend. Seasonal rainfall analyses based on data from meteorological stations in the study area show notable decreases in the winter and pre-monsoon periods. In Champawat and Ramnagar, where Mann-Kendall value drops exceeded -5, this is particularly noticeable. These trends show how the climate is changing, necessitating

quick regional mitigation and adaptation plans. The study made clear how urgently sustainable development solutions are needed in this environmentally fragile region, with a particular emphasis on conservation and climate adaptation to address ecosystem deterioration.

Keywords: *Kumaun Himalaya; Geospatial; Climate Change; Environmental Indicators; Remote Sensing and GIS; GEE*

Natural Resource Conservation and Sustainable Utilization

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ABSTRACT

Conservation and sustainable utilization of natural resources are essential for maintaining ecological balance and ensuring the well-being of future generations. Natural resources such as water, soil, air, forests and minerals are finite and are being depleted at an alarming rate due to unsustainable human activities, industrial expansion and population growth. This paper focuses on the urgent need to adopt strategies that promote the careful management and responsible use of these resources. Sustainable practices such as afforestation, rainwater harvesting, renewable energy utilization, soil conservation and sustainable agriculture play a vital role in preserving the environment.

India, being a country with diverse ecosystems and a large population dependent on natural resources for livelihood, faces serious environmental challenges. Overexploitation of groundwater, deforestation, land degradation and pollution of water bodies are some of the critical issues that demand immediate attention. By integrating traditional knowledge with modern scientific approaches, sustainable development can be achieved at both local and national levels. Government initiatives like the National Mission for a Green India, soil health card schemes and promotion of solar and wind energy also contribute significantly to resource conservation.

Moreover, awareness and active participation of communities, especially in rural areas, are vital for the successful implementation of conservation strategies. Education, capacity- building, and use of modern technologies such as Geographic Information Systems (GIS) and remote sensing help monitor environmental changes and guide effective decision-making. The conservation of biodiversity, reduction of carbon emissions, and efficient use of natural resources are not only essential for environmental health but also for economic stability and social well-being.

Keywords: *Natural resources; sustainability; conservation; renewable energy; biodiversity; water management; eco-friendly practices; sustainable development.*

Forest Degradation and Desertification

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ABSTRACT

Forest degradation and desertification represent two of the most critical environmental challenges globally, particularly in regions facing increasing population pressure, climate variability and unsustainable land use practices. Forest degradation refers to the decline in forest quality, biodiversity and ecosystem services due to activities such as illegal logging, overgrazing and forest fires. Desertification, often a result of deforestation and land mis management, involves the transformation of fertile land into arid, unproductive zones. Together, these processes threaten the livelihoods of millions, exacerbate poverty and contribute significantly to global climate change.

In countries with high dependence on forest resources and agriculture, the impact of forest degradation and desertification is especially severe. Reduced vegetation cover not only accelerates soil erosion and water scarcity but also disrupts local climate regulation and carbon sequestration. Initiatives such as afforestation, sustainable forest management and community-based land restoration are being implemented to combat these issues. Technological interventions including satellite monitoring, GIS-based land assessment, and early warning systems are helping track and reverse degradation trends. Efforts to mitigate forest degradation and desertification are essential to achieving the United Nations Sustainable Development Goals (SDGs), particularly those related to climate action, life on land and sustainable communities. Integrated policy frameworks, local stakeholder participation, and international cooperation remain vital for restoring degraded ecosystems and promoting environmental resilience.

Keywords: *Forest degradation; desertification; climate change; sustainable land management; afforestation; biodiversity loss; environmental conservation*

Aromatic Rice Germplasm Evaluation for Flood-Prone Ecologies under Changing Climate

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ABSTRACT

Climate change is intensifying extreme weather events, including recurrent floods, which severely threaten rice production in eastern India. Developing and identifying flood-tolerant varieties is essential to safeguard food security and sustain farmers' livelihoods in these vulnerable regions. This study, conducted in 2021-22, aimed to assess the performance of aromatic rice germplasm under flood-prone conditions in Bihar and Assam. The selected sites included Darbhanga and Madhubani districts in Bihar, and Lakhimpur and Dhemaji districts in Assam. Twenty aromatic rice germplasm collected from these areas were further evaluated at ICAR-RCER, Patna, using a randomized block design with three replications. Morphological and yield traits like plant height, panicle length, panicle number, days to flowering, and grain yield were recorded. Statistical analysis revealed significant positive correlations between panicle length with both plant height and days to flowering, and between grain yield with plant height. Tulsiphul-2 and Katarni had the longest flowering duration, while Marchadhan was the earliest. Kamod recorded the tallest plants, while Bhoga Joha was the shortest. Marchadhan had the longest panicle, and Katarni the shortest. Satlakha Local recorded the highest grain yield (2.65 t/ha). Principal Component Analysis indicated plant height, panicle length, and grain yield as key contributors to variability. Satlakha Local, Kanakjeera, and Kamod emerged as promising flood-tolerant germplasm, offering valuable options for farmers and actionable insights for policymakers to strengthen climate adaptation strategies in eastern India's rice sector.

Key words: *Climate change; flood tolerant rice; aromatic rice; eastern India*

Genetic Variability Studies for Fodder Quality Parameters In Brown Midrib Sorghum.

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ABSTRACT

Sorghum has great potential for fodder production under moisture stress conditions with limited resources as compared to other cereals especially maize. It is playing an important role in fodder availability throughout the year. In addition to quantity, quality of feed is also important to achieve

better nutrition to the livestock and quality of by products. The degree of variability in the desired character in the base material is well established. Therefore present investigation was carried out to estimate genetic variability for fodder quality parameters and fodder yield in 28 brown midrib sorghum genotypes. The experiment was carried out in randomized block design with two replications at sorghum Research Station, VNMKV Parbhani. The observations for all the traits were recorded on five randomly selected plants in each replication. The Result revealed high estimates of genotypic coefficient of variation (GCV), phenotypic coefficient of variation (PCV) for the traits viz. plant height (cm), grain yield per plant, acid detergent lignin, hemicellulose while moderate GCV and PCV was observed for fodder yield per plant and low GCV and PCV was observed for days to 50% flowering, crude protein, neutral detergent fiber, acid detergent fiber. Low GCV but high PCV was observed for cellulose. High heritability coupled with high expected genetic advance were exhibited for the characters viz. plant height, fodder yield per plant, grain yield per plant, crude protein, neutral detergent fiber, acid detergent fiber and acid detergent lignin. Further selection of these characters will improve the breeding efficiency of genotypes.

Keywords: *Brown midrib sorghum; genetic variability; heritability genetic advance*

Heterosis for Fodder Yield and its Contributing Traits in Sorghum Hybrids

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ABSTRACT

An experiment was conducted to assess the extent of heterosis for fodder yield and its contributing traits in sorghum (*Sorghum bicolor* (L.) Moench) crosses using line x tester mating design. Thirty hybrids derived from mating five testers with six lines in L x T design along with their parents and two checks viz., CSH 15 R and CSV 22 R were evaluated in Randomized Block Design with three replications. Observations were recorded on randomly selected 5 five plants in each replication for grain yield and its contributing characters. Results evidenced the higher estimates of sca variances than the corresponding gca variances for the characters plant height, plant height, number of leaves, L:S ratio, grain yield, fodder yield, biological yield and harvest index indicating preponderance of non additive gene effects controlling the traits. Crosses; Parbhani Moti x PBMR 5, PMS 71B x PBMR 5, CSV 29R x PBMR 3, MS 104B x PBMR 3, ICSR 196 x PBMR 3 and Phule Anuradha x PBMR 3 possessed significantly desirable heterosis and *per se* performance for fodder yield per plant. Parbhani Moti x PBMR 5, PMS 71B x PBMR 5 and ICSR 196 x PBMR 3 have also shown good perse performance and heterosis for fodder contributing traits plant height, no. of leaves, leaf area, biomass and stem girth. While hybrids CSV 29 R x PBMR 3, Parbhani Moti X PBMR 4, Phule Anuradha x PBMR 4, Parbhani Moti x PBMR 1 and MS 104B x PBMR 3 expressed significant superiority for heterobeliosis and standard heterosis for grain yield. Cross CSV 29 R x PBMR 3 and Parbhani Moti x Pbm 5 are promising for developing dual purpose genotypes.

Keywords: *sorghum; heterosis; line x tester mating design*

Carbon sequestration potential of Multipurpose Trees at Humid tropics**Narendra Kumar, Prabhat Ranjan Oraon*, Abhay Kumar, M. S. Malik and Jyotish Kumar Kerketta***Department of Silviculture and Agroforestry, Faculty of Forestry, Birsa Agricultural University, Jharkhand, India.***ABSTRACT**

The present investigation entitled “Carbon sequestration potential of Multipurpose Trees in humid tropics” was carried out at longitude 23°26' N and latitude 85°20' E, 641.29 m above the mean sea level of Ranchi district Jharkhand. Results indicated that the aboveground biomass, belowground biomass and total Biomass of multipurpose tree was greater in *Acacia auriculiformis* 248.45, 64.60 and 313.04 t ha⁻¹ followed by *Dalbergia sissoo* 33.35, 8.67 and 42.02 t ha⁻¹ and lowest in *Artocarpus heterophyllus* 1.60, 0.42 and 2.02 t ha⁻¹, respectively. The total carbon stock was recorded highest under the treatment *Acacia auriculiformis* 167.94 t ha⁻¹ followed by *Dalbergia sissoo* 30.64 t ha⁻¹ and least was found in *Artocarpus heterophyllus* 10.87 t ha⁻¹ whereas, the total carbon sequestration was highest observed in treatment *Acacia auriculiformis* 616.34 t ha⁻¹ followed by *Dalbergia sissoo* 112.45 t ha⁻¹ least was found in *Artocarpus heterophyllus* 39.89 t ha⁻¹. The maximum biomass, total carbon stock and total carbon sequestration were found in *Acacia auriculiformis* 313.04, 167.94 and 616.34 t ha⁻¹, respectively. *Acacia auriculiformis* tree perform best among all the treatments followed by *Dalbergia sissoo* and *Gmelina arborea* and these species recommend for the plantation in the community land of Jharkhand to produce fuel wood, fodder, and fertilizer.

Keywords: Growth; Biomass; Carbon stock; Carbon Sequestration; Multipurpose tree

Diversity of Ectomycorrhizal Fungi in Lower Subansiri, Arunachal Pradesh**Mudang Yampi, Girish Gogoi, Kambam Boxen Meetei, and Prasanta Kardong***Silviculture and Forest Management Division, ICFRE-Rain Forest Research Institute Jorhat, Assam, India.***ABSTRACT**

Ectomycorrhizal (ECM) fungi are important components of forest ecosystems, which form mutualistic symbiotic associations with a wide range of forestry tree species and play important functions such as nutrient cycling, soil health, and decomposition. Despite their ecological importance, ECM fungal diversity in Arunachal Pradesh remains poorly studied. This study documents ECM fungal diversity in the Lower Subansiri district, Arunachal Pradesh. Field surveys were conducted in coniferous and mixed forest types from 2023 to 2025. Following the random sampling points, surveys were carried out in different seasons, with a plot size of 20 × 250 meters at each sampling point. Fruiting bodies were collected and identified based on morphological characteristics, and host associations were identified through published literature. The study revealed that the region harbours a diverse range of Ectomycorrhizal fungi. The species recorded in this study may have potential applications in forestry, including the production of quality planting materials in nurseries to support forest regeneration and the improvement of seedling survival and growth in degraded forest areas.

Keywords: Ectomycorrhizal fungi; forest biodiversity; Arunachal Pradesh; forestry tree species

Hydroponics -An Alternative Tool For Intensified Agriculture – An Overview**Sumant. B. Jadhav, Vishal. K. Ingle, Gopal. U. Shinde and Harish Awari***College of Agricultural Engineering and Technology, VNMKV, Parbhani, India.***ABSTRACT**

With the advancement of civilization, open-field or soil-based agriculture is facing several major challenges, the most significant being the decrease in per capita land availability. In 1960, with a global population of 3 billion, per capita land availability was 0.5 hectares. Currently, with a population of 6 billion, it has reduced to only 0.25 hectares, and by 2050, it is expected to drop further to 0.16 hectares. Rapid urbanization and industrialization, along with the melting of icebergs due to global warming, are causing a further decline in arable land. Additionally, soil fertility has reached a saturation point, and increasing fertilizer application is no longer leading to improved productivity. Poor soil fertility in certain cultivable areas, reduced natural microbial activity due to continuous farming, frequent droughts, unpredictable weather patterns, rising temperatures, river pollution, inefficient water management, excessive water wastage, and declining groundwater levels are all posing serious threats to food production through conventional soil-based agriculture. Given these circumstances, it will soon become nearly impossible to feed the global population using open-field agricultural systems alone. As a result, soil-less farming methods are gaining increasing relevance in addressing these challenges. In soil-less cultivation, plants are grown without soil, using nutrient-rich solutions. These innovative methods, which conserve space and water, have shown promising results around the world.

Keywords: *Soil less culture; Hydroponics; nutrient solution etc*

Mapping Of Medicinal Plants In The World With Special Reference To India**Zeba and Dr. Neha Pathak***Department of Botany, Sanskriti University, Mathura, U.P., India.***ABSTRACT**

The paper deals with various aspects of medicinal plants such as concept, meaning and definitions, characteristics, classification of plant, types and importance of plants etc. The paper highlights mapping of medicinal plants at global level pointed out location of medicinal plants in the world. It also deals with location of medicinal plants in Indian perspective focusing various type of medicinal plants available in different parts of the country. It also point out impact of medicinal plants in the life of peoples of the country in terms of health, generation of income resources, cultural and environmental aspects. The paper also suggest sustainable development of medicinal plants keeping in view to fulfill needs of the people of the country at the present time as well as for future generation .

Keywords: *Medicinal plants; World Medicinal Plants; Indian Medicinal Plants; Role of Medicinal Plants*

Farm women Awareness on Climate Change for Climate Smart Agriculture**Sarah Kamala, Uma Jyothi***Jayashankar State Agricultural University, Hyderabad, India.***ABSTRACT**

Empowering farmwomen to respond to the challenges posed by climate change is the need of the hour. Climate change and environmental degradation represent a great threat to poverty reduction, gender equality and to achieve the Sustainable Development Goals (SGDs). Its impact is not only on food production but also on health, food security, nutrition, migration, and people's earnings. Awareness, perceptions and knowledge play a key role in shaping individual and collective response to climate

change. Understanding gender dimensions of climate change, awareness and knowledge contributes to effective climate change adaptation. Climate-smart agriculture (CSA) is one of the integrative approach to address these interlinked challenges of food security and climate change, clearly aiming at food security, increase productivity and incomes, build resilience to climate change, and reduce emissions from agricultural systems. Farms, crops, livestock aquaculture and Fisheries Management, better resource management as well ecosystem and land management leading to the increase in the resource efficiency and resilience. CSA provide a platform for shared learning and collaboration among all interested Farm women and Farmers. The study explored the awareness levels of the farm women from 6 adopted villages of All India Coordinated Project on Home Science (AICRP –HSc) through questionnaire-based personal interviews involving 100 respondents. Majority of the respondents were farmers with marginal and small land holdings. Findings of the study revealed that most (74) of the respondents are not very well aware of the climate change. Whereas only few (26) of the respondents were aware that deforestation is the main cause for the climate change. Hence the study recommends a requirement for scientists, government and non-government agents and other stakeholders to focus on awareness creation on climate change and mitigating approaches in perception of crop Rotation, drought tolerant varieties, Zero Tillage, Weather Forecasting, Indigenous technologies etc.

Keywords: *Awareness; climate change; farm women; Climate Smart agriculture.*

Effect Of Plant Growth Regulators On Growth And Yield Of Leafy Vegetables Under Protected Conditions

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ABSTRACT

Leafy vegetables are a nourishing source of dietary fibre, vitamin C, A, E, K, and B complexes, as well as minerals such as phosphorus, magnesium, calcium, and iron. Green leafy vegetables, which are frequently referred to as "protective foods," are rich in a variety of bioactive compounds and micronutrients that strengthen the immune system and prevent the development of diseases. An investigation into the effect of different types of plant growth regulators on leafy vegetables under polyhouse conditions in Chengalpattu district of Tamil Nadu at the SRM College of Agricultural Science. Plant growth regulators in Amaranthus greatly increase leaf breadth (9.49cm), leaf length (21.11cm), plant height (38.32cm), plant weight (39.67g), root length (10.04cm), stem length (28.82cm), and weight per bundle (482.80g). There is a significant positive correlation between plant growth regulators and the following characteristics of coriander plants: weight per bundle (482.80g), root length (11.0cm), stem length (28.8cm), leaf length (21.2cm), plant height (38.3cm), and plant weight (39.6g). Growth regulators have a major and beneficial effect on the plant height (43.58cm) and plant weight (21.69g) of Palak plants. Amaranthus and palak yield more economically when treated with the growth regulator indole-3-butyric acid (IBA). The economic yield of coriander is increased by the growth regulator benzyle adenine (BA).

Keywords: *Amaranthus; palak; coriander; growth regulators; polyhouse; growth and yield*

Stress ameliorating potential of seed priming in pea under moisture stress conditions**Yanglem Sofia Devi***Krishi Vigyan Kendra, East Garo Hills, Central Agricultural University (Imphal), Meghalaya, India.***ABSTRACT**

To increase crop production under stressful environment of hill ecosystems of Meghalaya in Eastern Himalaya, modern agro-technologies are in the urgent need. A pot experiment was conducted in outdoor condition with four moisture regimes viz., I₁ - Irrigation at alternate day's interval, I₂ - Irrigation at 7 days interval, I₃ - Irrigation at 15 days interval and I₄ - completely rainfed and five seed priming treatments viz., P₁ - 10 mM H₂O₂, P₂ - 1.5% KH₂PO₄, P₃ - 5% PEG, P₄ - 2 μM ABA and P₅ - Priming control were chosen for the study. Results revealed that leaf chlorophyll, photosynthetic parameters, chlorophyll fluorescence, stomatal attributes, root morphology, leaf water potential and RWC have increased whereas leaf temperature, leaf MDA & leaf proline have decreased in priming compared to non priming. Under stressful condition, scheduling irrigation at alternate days intervals and seed priming with 1.5% KH₂PO₄ and 10mM H₂O₂ has showed greater growth advantage by inducing remarkable physiological response, significantly favoured root architecture, reduced lipid peroxidation, increased photosynthetic rate and impart noticeable changes stomatal and non-stomatal water loss. Therefore, seed priming with 1.5% KH₂PO₄ or 10mM H₂O₂ aid the pea crop plant to grow better under moisture stressful environment.

Keywords: *Moisture regimes; seed priming; photosynthetic response; stomatal attributes and root morphology*

Effect of Supplementation of Area Specific Mineral Mixture on Body Condition Score (BCS) in Murrah buffaloes**Mohd Faiz, Debashis Roy, Ajit Kumar, Ahmad Fahim, Gulab Chandra, Ashutosh Tripathi, Shainy Kapil, Yashesh Singh, Shalu Singh and Sonu Singh***Department of Animal Nutrition, Sardar Vallabh Patel University of Agriculture and Technology Meerut, U.P., India.***ABSTRACT**

The experiment was conducted to find the effect of supplementation of area specific mineral mixture on body condition score (bcs) in murrah buffaloes. The experiment was conducted at the Livestock Research Center, Sardar Vallabh Patel University of Agriculture & Technology, Modipuram, Meerut 250110 (UP). A trial of 4 months (1 month before and 3 months after parturition) was conducted and a total of 18 murrah buffaloes in advanced pregnancy (about one month before expected parturition date) was selected and were divided into 3 equal groups each containing 6 animals, on body weight basis. The animals were fed concentrate mixture, wheat straw and locally available green fodders to meet the nutrient requirement for buffaloes. The animals were fed as per the kearl (1982) feeding standard to meet the requirement of animals. The different groups of animals were fed with the different diets. In Group 1 (control), animals were fed with the basal diet without any mineral mixture added in diet. In Group 2, animals were fed with basal diet with addition of area specific mineral mixture @50gm/animal/day. In Group 3, animals were fed with basal diet with addition of BIS Type-1 specification mineral mixture @50gm/animal/day. The effect on the body condition score was studied on the experimental animals. The value of BCS at day 0 of G1, G2 and G3 was 3.05, 3.43 and 2.98 respectively. At day 30 (just after parturition) the BCS of G1, G2, G3 was found 2.90, 3.35 and 2.84, respectively. The decline in BCS at day 30 was less in G2 as compared to the G1 and G3 but no significant difference was found. At day 120 the BCS of G1, G2 and G3 was 2.81, 3.27 and 2.93, respectively. The average values of BCS (120 days) for G1, G2 and G3 was recorded 2.83, 3.25 and

3.84, respectively. The range of values of BCS for G1, G2 and G3 are 2.73 to 3.05, 3.08 to 3.43 and 2.63 to 2.98, respectively. The conclusion of the experiment was that no significant difference in BCS was observed among G1, G2, and G3. The decline in BCS on the day of parturition was less in G2 compared to G1 and G3, and the post-parturition recovery was relatively better in G3 than in G1 and G2, although not statistically significant.

Enhancing Chickpea (*Cicer arietinum* L.) Yield through Integrated Nutrient Scheduling and Strategic Weed Suppression: A Sustainable Agronomic Approach

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ABSTRACT

Chickpea is a vital pulse crop for both human nutrition and soil health due to its nitrogen-fixing ability. However, its productivity in India remains sub-optimal, primarily due to nutrient imbalances and severe weed competition during early crop stages. Current agronomic practices often address these issues independently, leading to partial benefits and limited economic returns. Integrated approaches combining nutrient optimization and effective weed management are underexplored in chickpea production systems. This study aimed to evaluate synergistic nutrient–weed management strategies to enhance yield, profitability and sustainability of chickpea cultivation under the agro-climatic conditions of Varanasi, Uttar Pradesh. While chickpea agronomy has seen advances in varietal improvement and single-input interventions (either nutrient management or weed control), there is insufficient empirical evidence on how combined nutrient optimization—including biofertilizer inoculation and foliar supplementation—interacts with herbicide–manual weeding sequences to maximize productivity, profitability and soil health in the Indo-Gangetic Plains (IGPs). This study addresses this gap by integrating multi-nutrient strategies with sequential weed control measures.

Materials and Methods

A two-year field experiment was conducted during *Rabi* seasons of 2022–23 and 2023–24 at the Agricultural Research Farm, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi. The experiment followed a split-plot design with three replications. involved four nutrient levels—F₀: control (no fertilizer), F₁: 100% recommended dose of fertilizer (RDF) i.e. 20:60:20 kg/ha N, P₂O₅, K₂O, F₂: 75% RDF with seed treatment using *Rhizobium* and PSB and F₃: 50% RDF with seed treatment using *Rhizobium*, PSB, molybdenum (2g/kg seed) with foliar sprays of 0.5% boron and 2% urea at pre flowering and pod development stage and in sub-plot there were eight weed management treatments, including W₁: pendimethalin (1.0 kg/ha) as pre-emergence (PE), W₂: quizalofop-p-ethyl (50 g/ha), W₃: topramezone (20.6 g/ha) as post-emergence (PoE), combinations of herbicides with hand weeding (HW) i.e. W₄: pendimethalin followed by 1 HW (35 DAS), W₅: pendimethalin followed by quizalofop, W₆: pendimethalin followed by topramezone, W₇: weedy-check (control) and W₈: weed-free conditions. Weed sampling was conducted by randomly placing three quadrats (0.5 × 0.5 m) in each net plot. All weeds within each quadrat were uprooted, species were identified and counted and weed density was expressed as number m⁻². For biomass estimation, the weeds were cut at the soil surface from border row, oven-dried at 65 °C for 72 hrs. and weighed. As the data showed wide variation, both weed density and biomass values were normalized using square-root transformation $\sqrt{(x + 0.5)}$ before analysis of variance. Harvesting was carried out manually with a sickle, cutting the wheat a few centimetres above ground level. The crop was left in the field for two days for drying, then threshed using a power-operated thresher, winnowed, and the grains weighed with a balance and bagged separately. The recorded data were subjected to statistical analysis for drawing valid conclusions.

Results

Across both years, 100% RDF combined with pendimethalin followed by one hand weeding at 35 DAS significantly minimized weed density and weed dry biomass, leading to the highest chickpea grain yield. This treatment was statistically on par with 75% RDF + *Rhizobium* + PSB seed inoculation combined with pendimethalin followed by topramezone application. These integrated treatments improved nutrient uptake efficiency, maintained superior crop–weed competition dynamics and enhanced net returns compared to single-component management. Yield benefits ranged from 18–32% over sole chemical weed control and 45–60% over the weedy check. Biofertilizer use in reduced RDF regimes sustained soil health indicators while cutting input costs, making the package more sustainable.

Conclusions

The findings highlight that integrating balanced nutrient scheduling with sequential herbicide–manual weed control is an agronomically and economically viable strategy for chickpea growers. The most profitable package under Varanasi conditions was 100% RDF + pendimethalin (PE) followed by one hand weeding (35 DAS), closely followed by 75% RDF + biofertilizers + pendimethalin (PE) followed by topramezone. Such integrated interventions can enhance productivity, profitability and long-term soil fertility while reducing environmental footprint from excessive chemical use.

Commercial cultivation of *Mentha arvensis* L. through Integrated Nutrient Management (INM)

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ABSTRACT

Mentha arvensis L. is a potential aromatic plant used for making a large number of herbal and pharmaceutical products. The essential oil extracted from leaves are widely used for making healthcare products towards potent therapeutic activities like liver disorder, oro-dental care, skin care, shaving cream, anti cough etc. In the recent past years globally, there are great demands for essential oil of *Mentha* leaves. In the present paper the studies on yield of *Mentha* leaves based on the fertilizers application of Farm Yard Manure (FYM) and lime. The treatment consists of lime 0.3 and 0.5 ton/ha with FYM 2.5 and 5.0 ton/ha in different combination. The source of lime was paper mill sludge having the CaCO_3 equivalent of 68%. Constant doses of N, P_2O_5 and K_2O were applied 80 :40: 40 kg/ha, respectively. Results of the experiment revealed that application of lime and FYM significantly increased the growth of plant height, roots, leaves and stem weights, herbage and oil yield. Maximum leaves, herbage and oil yield of 110 q/ha, 318 q/ha and 44 kg/ha, respectively were obtained with application of lime 0.3 ton/ha along with FYM 5 ton/ha. Application of lime has no effect in increasing the oil content, whereas FYM has a significant effect in increasing the oil content in *M. arvensis*. The above application has enhanced the significant crop productivity of soil. The above data have been compared with earlier researches in INM of *Mentha* and it has been observed that oil content and foliage yield in *Mentha* plants increased the levels of NPK fertilizers and FYM.

Keywords: *Mentha arvensis*; Integrated Nutrient Management; Productivity

Characterization spectra of *Amomum subulatum* and *Paris polyphylla*: A qualitative phytochemical profile of high value medicinal plants**Jit Narayan Sah* and Kabita Gaire***Institute of Forestry, Pokhara Campus, Pokhara, Tribhuvan University, Nepal.***ABSTRACT**

The various phytochemical chemical compounds present within the medicinal plants, they serve as the main source of medicinal value to communities residing in the Hilly and Himalayan region of Nepal, that do not have easy access to modern medicines. The laboratory tests were conducted to determine the phytochemical analysis of the two most widely used medicinal plants in Nepal viz., *Amomum subulatum* (Black cardamom) and *Paris polyphylla* (Satuwa). The objective of the study was to conduct the phytochemical screening of these plants and characterize the spectra on each compound present in the plants. Extract of the plants was obtained by Soxhlet's extraction method which was further taken for the test. A qualitative phytochemical analysis was performed for the detection of a total of eight metabolites with respective tests viz; glycosides, saponins, carbohydrates, proteins, fats & oils, tannins, steroids/triterpenoids, and flavonoids. The crude extract of each plant was subjected to methanol and pet ether and the qualitative screening was undertaken. Black cardamom showed the absence of saponins and glycosides, whereas Satuwa marked the absence of flavonoids on the methanol extract. Similarly, Black cardamom was marked with the absence of glycosides, fats, and oils whereas, Satuwa showed the absence of steroids/triterpenoids on the pet ether extract. The wavelengths for eight metabolites ranged from 200 nm-600 nm since wavelength value depends upon altitude and aspects of plants. Absorbance and transmittance capacity of plants were determined by UV-Vis. Spectrophotometer and IR Spectrophotometer. The characterization showed absorbance capacity ranging from 0.030-2.440AU and transmittance of 0.36-93.1% at different spectra. The findings validate the traditional medicinal uses of these Himalayan plants and indicate their potential for therapeutic applications.

Keywords: *Amomum subulatum*; *Paris polyphylla*; phytochemical analysis; Spectrophotometer and Wavelength spectra

Climate Change And Feminization Of Agriculture: Evidence From Bihar's Smallholder And Marginal Farmers**Vibha Kumari, Supriyo Ghorui***School of Agriculture and Rural Development, Ramakrishna Mission Vivekananda Educational and Research Institute, Narendrapur, Kolkata, India.***ABSTRACT**

Climate change has emerged as a significant worldwide concern in recent decades. The growing evidence of global warming the warming of the seas and temperatures brought on by greenhouse gas emissions has severely disrupted agricultural systems, human well-being, and ecosystems. By recording their perceptions, difficulties, and adaption tactics in the face of climatic uncertainty, the current study seeks to comprehend how these changes in the climate affect the livelihoods of women farmers. Data were collected from 51 women farmers involved in agriculture and allied sections between February and May 2025 through semi-structured interviews, supplemented and validated by Focus Groups Discussions (FGDs) and Participatory Rural Appraisal (PRA) tools and techniques. Additionally, the Analytical Hierarchy Process (AHP), was applied to priorities the adaptation strategies followed by the women farmers. Based on my field observation and farmers perception, drought (45%) emerged as the most significant sources of Agriculture stress due to erratic monsoon patterns and reduced rainfall, which lead to prolonged soil moisture deficits. The second major stress factors if flood (35%) followed

by temperature (20%). Gender dynamics within the community have been further skewed by these recurrent natural disasters, which have caused males to go outside in search of better economic prospects and have resulted in worsening soil health owing to saline water intrusion. 12 widely used adaptation techniques were identified in all sectors, including Agriculture, Livestock and non-farm livelihood. Crop rotation (0.127), Reduced Expenses on food consumption (0.122), and mixed farming (0.111) were the top three adaptation strategies based on the relative importance of each technique. However, women farmers face gender-specific challenges such as inadequate resource availability and unequal power relations. The report emphasizes the critical need for gender-responsive climate policies and interventions to address the unique issues that women farmers confront in Bihar. Collaboration among stakeholders is critical for developing long-term adaption measures and increasing these farmers' resilience. Future study should evaluate the efficacy of these techniques and suggest best practices for improving their adaptive capacity in sensitive places.

Keywords: *Women Farmers; Climate Change; Impact and Adaptation; Feminization of Agriculture; Analytical Hierarchy Process.*

Spatiotemporal Analysis and Future Projection of LULC Changes in Dehradun City Using GIS and Remote Sensing

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ABSTRACT

Dehradun city, located in the fragile ecosystem of the Himalayan foothills, has experienced significant land use/land cover (LULC) transformations due to rapid urban growth, infrastructural development, and changing land dynamics. This study conducts a spatiotemporal analysis of LULC changes from 1990 to 2024 using multi-temporal Landsat satellite imagery and geospatial techniques. Supervised classification was performed using the Support Vector Machine (SVM) algorithm, which provided high accuracy in distinguishing LULC classes such as built-up areas, vegetation, agricultural land, water bodies, and barren land. The classification accuracy was evaluated using the Kappa coefficient, ensuring the reliability of the results. To forecast future land cover scenarios, the MOLUSCE (Modules for Land Use Change Evaluation) plugin in QGIS was utilized, integrating the Cellular Automata–Artificial Neural Network (CA–ANN) model to project LULC for the years 2050 and 2100. The projections reveal a continuous expansion of built-up areas at the expense of vegetative and agricultural lands, raising serious concerns about environmental sustainability. This study demonstrates the effectiveness of combining remote sensing, machine learning classification, and predictive modeling to support informed urban planning and resource management in rapidly urbanizing regions.

Assessment Of Occupational Health Hazards Of Women In Agriculture And Allied Sector In Indian Sundarbans

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ABSTRACT

Agriculture in the Indian Sundarban has become increasingly dependent on women due to male outmigration and the region's vulnerability to climate change. However, women farmers continue to face serious health risks due to occupational stress, poor working conditions, and lack of access to sanitation and healthcare. This study investigates the occupational health hazards experienced by women engaged in agriculture and allied activities in two blocks of South 24 Parganas, West Bengal.

The hazards identified include physical (back pain, fever, cold), chemical (gynaecological and menstrual disorders), mechanical (musculoskeletal strain), biological (typhoid), psychosocial (hypertension), and ergonomic (muscle cramps, postural injuries) risks. Since Cyclone Aila in 2009, saline intrusion has severely impacted agriculture, prompting male migration and increasing women's participation across the agricultural value chain—from pre-harvest to marketing—while still managing household responsibilities. Primary data were collected through semi-structured interviews, household surveys, focus group discussions and participatory rural appraisal (PRA) techniques such as daily routine, spider diagram, trend analysis and problem tree. Findings reveal that women suffer from a wide range of health issues including acidity, headaches, skin and fungal infections, allergies, and heat-related illnesses like dizziness, fatigue, dry skin, and unconsciousness. Coping strategies include increased water intake, oral rehydration solution (ORS) consumption, frequent bathing, use of cotton clothing and head coverings, and dietary adjustments. Despite their critical role, women lack land ownership and decision-making power. Ergonomic interventions are largely absent in the region. The study recommends introducing gender-sensitive tools, personal protective equipment (PPE), social protection measures, and policy support. Further research and ergonomic innovations are essential to safeguard the health and livelihoods of women farmers in the Sundarban.

Keywords: *Climate Change; Indian Sundarban; Heat Stress; Occupational Health Hazards; Ergonomic Interventions*

Digital Technologies for Elderly in Natural Disasters

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ABSTRACT

Climate emergencies, such as floods, heatwaves, droughts, and cyclones, pose significant threats to elderly due to their age-related vulnerabilities, limited mobility, chronic health conditions, and social isolation. In this context, digital and assistive technologies have emerged as vital tools to enhance resilience, ensure safety, and support the well-being of older adults before, during, and after climate-induced disasters. This article explores how various technologies can be harnessed to address the unique needs of elderly during climate emergencies. Technologies such as wearable alert monitors, GPS enabled devices, early warning mobile applications, AI voice assistants, telehealth platforms, and climate-adaptive assistive devices are increasingly being employed to monitor vital signs, issue timely alerts, enable real-time communication, and provide employed support. Community-based digital platforms also facilitate social connectedness, access to resources, and coordination of care, particularly those who live alone or in remote areas. These technologies not only help to reduce physical risks and psychological distress among older adults but also empower them with autonomy and dignity during crises. Integrating these technologies into disaster management supports inclusive policy-making, enabling age-sensitive responses, stronger early warning systems, and efficient resource allocation in disaster management and long-term adaptation.

Keywords: *Digital Technologies; Elderly; Natural Disasters*

SMART AGRICULTURE: ICT, ITK, IPR AND TOT**Agantika Gupta***Agricultural Extension Education, Sardar Vallabhbhai Patel University of Agriculture and technology Modipuram, Meerut, U. P., India.***ABSTRACT**

In recent years, farming has been pulled in two seemingly opposite directions, towards the precision and speed of digital technology, and towards the slower, more place-bound wisdom of traditional practice. The idea that Information and Communication Technology (ICT), Indigenous Technical Knowledge (ITK), Intellectual Property Rights (IPR), and Technology Transfer (TOT) can all be brought together into a coherent framework is not just a theoretical suggestion; it is a trend visible on the ground in many parts of the world, including India. ICT tools, whether they involve simple SMS weather alerts or sophisticated remote sensing and IoT-enabled irrigation, are helping farmers to make decisions with a level of accuracy that, until recently, was the preserve of agricultural scientists (Reddy & Reddy, 2020). In parts of rural India, one can see farmers checking soil moisture data on their phones, a scene that would have been unusual even five years ago (FAO, 2021; Meera, Jhamtani, & Rao, 2004). Still, this does not mean older systems of knowledge have been made redundant. On the contrary, ITK, often passed down orally or by imitation, continues to guide seed selection, crop rotation, pest control, and water management (Agrawal, 1995; Saha, 2018). This kind of knowledge is rarely “static”; it shifts with the seasons, the local ecology, and the farmer’s own judgement. Some of these practices, such as intercropping or herbal pest repellents, also align with contemporary sustainability goals (Singh & Sureja, 2008). When researchers digitise these practices, or create apps that catalogue and map them, the result is not a replacement of tradition but a dialogue between the new and the old (Altieri & Nicholls, 2017).

The legal framework around IPR adds yet another layer. If new seeds, digital platforms, or even unique traditional products are to be shared fairly, there must be clear rules about who owns what and who benefits from its use (Correa, 2000; Srinivasan, 2011). In India, the Protection of Plant Varieties and Farmers’ Rights Act attempts to balance the interests of commercial plant breeders with those of the farming communities who have maintained and improved local varieties over centuries (Swaminathan, 2007; Gopalakrishnan & Kumar, 2011). This is particularly important in preventing cases where local knowledge or resources are patented elsewhere without consent, a problem often described as “biopiracy” (Shiva, 2001; WIPO, 2020).

TOT is where these different strands, technology, tradition, and law, meet in practice. Extension workers, NGOs, private agribusinesses, and even informal farmer-to-farmer exchanges form part of the network that carries innovations from their source to the field (Rogers, 2003). Some TOT programmes fail because they assume a technology can be “dropped in” without adaptation, while the more successful ones tend to be those where farmers are directly involved in testing and modifying the tools to suit their land and climate (Ponnusamy & Pachaiyappan, 2018). This is why participatory approaches, demonstration farms, and collaborative trials are often more effective than top-down dissemination (World Bank, 2012; Anderson & Feder, 2007).

Taken together, ICT, ITK, IPR, and TOT do not form a single, rigid “smart agriculture” model. Instead, they offer a set of interlinked possibilities that can be combined differently depending on the local context, the crops grown, and the socio-economic setting (Pingali, 2012; Pretty et al., 2018). There are, however, conditions that must be met if this integration is to work in a fair and lasting way: rural infrastructure that can actually support digital tools, policy frameworks that respect both innovation and equity, and governance systems that make space for marginalised voices, including women farmers (Kumar et al., 2019; OECD, 2019; Meinzen-Dick et al., 2011).

The central challenge, and perhaps the real opportunity, is to ensure that as agriculture becomes “smarter”, it also becomes more inclusive, resilient, and rooted in the diverse ways people already know how to farm. If future research and policy pay close attention to local realities while encouraging innovation, the synergy between these four domains could be a significant driver of sustainable agricultural transformation (UNDP, 2020; Narula & Upadhyay, 2021).

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Climate Change – Challenges and Mitigation

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Introduction:

Climate change is a pressing global concern characterized by long-term alterations in climate patterns, largely driven by human activities such as fossil fuel combustion, deforestation and industrialization. The accumulation of greenhouse gases (GHGs) in the atmosphere has accelerated global warming, resulting in severe environmental, social and economic consequences.

Objectives:

This study aims to

- (a) Identify the primary causes and challenges of climate change.
- (b) Assess its impacts on ecosystems, human health and livelihoods. and (c) Examine effective mitigation strategies at global, national and individual levels.

Methods:

A qualitative review of secondary data was conducted, including Intergovernmental Panel on Climate Change (IPCC) reports, peer-reviewed journal articles and global policy documents. Case studies, such as India's solar energy initiatives and Sweden's carbon taxation model, were analyzed to evaluate the effectiveness of different mitigation approaches.

Results:

The findings indicate that climate change leads to rising global temperatures, melting glaciers, sea-level rise, extreme weather events, biodiversity loss and negative impacts on agriculture and public health. Effective mitigation strategies identified include large-scale adoption of renewable energy sources, afforestation and reforestation programs, sustainable agriculture, carbon pricing policies and public awareness campaigns. Countries implementing integrated policy measures and investing in green technologies have demonstrated significant progress in reducing emissions and enhancing climate resilience.

Conclusion:

Climate change poses complex and interconnected challenges that demand urgent and coordinated action. While the risks are substantial, timely mitigation strategies can significantly reduce GHG emissions and promote environmental sustainability. A combination of strong policy frameworks, technological innovation and individual behavioral changes is essential to address the crisis effectively. Global cooperation and commitment are critical to safeguarding the planet for future generations.

Keywords: *Climate change; greenhouse gases; global warming; mitigation strategies; renewable energy; sustainability*

Aquatic Fishes under Threat: Evaluating the Toxic Effects of Emerging Xenobiotic Pollutants in fish reproduction**Pankaj Mehta, Basit Masood Mattoo, Aakash Thakur and Sonal Parihar***Department of Biosciences, University Institute of Biotechnology, Chandigarh University, Mohali, Punjab, India.***ABSTRACT**

Xenobiotics are man-made chemicals widely used in daily life, from cleaning products and medicines to agricultural pesticides and industrial materials. As human activity increases, so does the presence of these compounds in the environment, especially in water bodies. A major concern is that most wastewater treatment plants are not fully effective in removing these substances. As a result, xenobiotics enter rivers, lakes, and oceans, often in very small amounts measured in nanograms or micrograms per litre, but even low concentrations can be harmful over time. Long-term exposure to these pollutants can affect both humans and animals, causing toxic, genetic, or hormone-related damage. Aquatic ecosystems are particularly vulnerable, and fish are among the most affected species. Because they live constantly in water, fish are exposed to xenobiotics that can interfere with their reproductive systems, damage their cells, or disrupt hormone levels, sometimes at doses far below what causes visible harm. This makes fish especially useful as indicators for early signs of environmental pollution. With today's scientific progress, we're now able to detect even the smallest traces of xenobiotics in water, helping us to better understand and manage pollution in aquatic environments. However, it remains challenging to fully understand their effects because so many different chemicals are often present at once, and their combined impact is not always clear. Numerous xenobiotics, such as endocrine disrupting chemicals (EDCs) and persistent organic pollutants (POPs), were reported on alter testicular morphology, occupy steroidogenesis and decrease sperm motility and viability. Studies have identified key genes associated with detoxification (e.g., CYP1A, GST), oxidative stress response (e.g. SOD, CAT), immune function (e.g., TNF- α , IL-1 β) and endocrine regulation (e.g. Vtg, ERs) which are compromised by xenobiotics exposure. These genetics changes may lead to impaired growth, reproduction and increased vulnerability to disease. The long-term ecological ramification of such disruptions encompass declining populations of fishes, a reduction in genetic diversity and wider effects on aquatic food webs, which could lead to species imbalances and destabilization of ecosystem. To deal with this growing concern, countries around the world must work together to set up rules that reduce xenobiotic pollution in ways that protect the environment while still being practical and affordable for everyday use.

Keywords: *Rainbow trout; Xenobiotics; Reproductive toxicity; Endocrine Disrupting chemicals [EDCs] Xenobiotics; Pesticide toxicity; Heavy metal toxicity; Oxidative Stress; Reactive Oxygen Species*

Aquaculture in a Changing Climate: Emerging Threats and Adaptive Responses**Shriya Thakur and Pankaj Mehta****Department of Biosciences, University Institute of Biotechnology, Chandigarh University, Mohali, Punjab, India.***ABSTRACT**

Aquatic ecosystems are already under pressure from overfishing, pollution, habitat loss, and invasive species. Now, climate change is adding even more stress, making these ecosystems even more vulnerable. Altogether, these issues are challenging the health and productivity of both wild and farmed fish populations. Changes in temperature, rainfall, sea levels, and the composition of seawater are already impacting fish growth and their overall health, and these challenges are becoming even more challenging as global temperatures rise by 3–4°C. Even small shifts in climate can upset coastal

ecosystems by changing the oxygen levels, salinity, and nutrient flows. Aquaculture is important for meeting the world's growing demand for seafood, but its dependence on stable environmental conditions makes it especially vulnerable to climate change. There are ways to reduce these risks. Innovations like smarter water management, breeding fish for climate tolerance, improved nutrition, and real-time environmental monitoring can help to make aquaculture systems more stable. However, solving these problems requires more than just technology. Making successful adaptations also requires smart policies, inclusive decision-making, and a better understanding of how living organisms and their environments react to multiple challenges over time. Tackling these challenges successfully will require combining computer models, observations from actual farms, and long-term experimental studies. To protect our future food supply, aquaculture must go beyond short-term fixes and adopt sustainable, evidence-based strategies. This will help in ensuring that it continues to provide healthy, reliable food even as the climate keeps changing.

Keywords: *Aquaculture; Integrated Multi-Trophic Aquaculture (IMTA); Recirculating aquaculture systems (RAS); Aquaponics*

Hematological Alterations Induced by Heavy Metal Stress: An Indicator of Toxicity for Assessing Fish Health in Contaminated Environment

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ABSTRACT

Contamination of water due to various pollutants present in environment leads to aquatic pollution. The presence of heavy metals in water bodies due to various anthropogenic and environmental causes like weathering of rocks, leaching of soil leads to progression of various diseases in aquatic organisms. Hematological examination that is commonly used to study the health and welfare of fishes in aquatic environment. These parameters are highly sensitive to stress caused due to any environmental factor like presence of heavy metals in water body. Accumulation of heavy metals in fish body leads to alteration of various hematological and histopathological parameters. The present study evaluates hematological and histopathological alterations in fishes, as well as biochemical analysis using biomarkers to assess their exposure to heavy metals. Various factors which affect heavy metal toxicity like dose and concentration, chemical interactions, pH, water hardness, life stage etc. are also mentioned along with their influence. Therefore, in conclusion, it was found that heavy metal stress induced hematological histopathological and biochemical alterations in fishes on exposure to heavy metals present in aquatic bodies.

Keywords: *Heavy metal stress; Haematology; Toxicokinetics*

Spatio-temporal variations in water quality of Katahal Nullah in Ballia district, UP, India**Sudhir Kumar Gupta¹, Anil Kumar Singh², Jay Prakash Singh³, and Amar Pal¹**¹*Department of Soil Science and Agricultural Chemistry, SMM Town PG College, Ballia Jananayak Chandrashekhar University, Ballia, UP, India.*²*Department of Soil Science and Agricultural Chemistry, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur, UP, India.*³*Department of Plant Pathology, SMM Town PG College, Jananayak Chandrashekhar University, Ballia, UP, India.***ABSTRACT**

The present investigation was carried out at SMM Town PG College, Ballia (Affiliated: Jananayak Chandrashekhar University, Ballia, UP, India) during July 2023 to June 2024. This study aimed to investigate the spatiotemporal variation in water quality of Katahal Nullah at various sites, including Brahmain, Bahadurpur, Parmandapur, Garwar Road, and Rampur Mahawal. Water quality parameters like temperature, pH, EC, ammoniacal nitrogen, phosphorus, calcium and magnesium, sodium, chloride, carbonate and bicarbonate, sulphur, and sodium adsorption ratio were monitored monthly for a year. Temporal variation shows the significant variation between months, and spatial variation reveals variability in sampling sites at different locations of Katahal Nullah. The results revealed spatiotemporal variation in the quality of Kathal Nullah water and highlighted significant fluctuations influenced by various factors, including seasonal changes, land use patterns, and anthropogenic activities. Water quality parameters exhibited distinct seasonal variations, with higher pollutant levels during winter, particularly for pH, P, Ca, Mg, Cl, and bicarbonate. Spatial analysis reveals that water quality varies significantly across locations, influenced by local geology, urbanization, and proximity to pollution sources, particularly Garwar Road and Parmandapur sampling sites.

Keywords: *Spatial; temporal; water quality***Media's influence on public climate awareness****Prakash Chandra Dwivedi**

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ABSTRACT

Media plays a crucial role in shaping public awareness, perception, and action regarding climate change. This article examines how traditional outlets (print, radio, television) and digital platforms (social media, blogs, podcasts) influence climate discourse. It explores the role of framing, emotional and rational appeals, and cultural context in shaping audience understanding. The study also addresses challenges such as misinformation, climate denial campaigns, algorithmic amplification of false content, and news fatigue. Case studies—including the “Fridays for Future” movement and coverage of extreme weather events—demonstrate media’s power to mobilize grassroots activism and influence policy agendas. The article argues for solutions-oriented journalism, collaborative science communication, participatory media strategies, and stronger media literacy to counter misinformation and foster constructive engagement. Ultimately, it concludes that well-informed, balanced, and inclusive climate reporting can transform climate change from a distant threat into a shared public priority, empowering communities and policymakers toward sustainable action.

A Study on Farmers' Attitudes Toward Livelihood Diversification**B. S. Lakshman Reddy, Mamathalakshmi, N. and Pallavi, G.***Department of Agricultural Extension Education, University of Horticultural Sciences, Bagalkot, Karnataka, India.***ABSTRACT**

The present research study was conducted in the Kolar district of Karnataka, India to analyse the attitude of farmers towards livelihood diversification and their extent of diversification. About fifty marginal, fifty small, fifty big farmers totalling 150 farmers constitute the sample. Standardized scale was developed to measure farmers' attitude towards livelihood diversification. The findings depict that majority (41.3%) farmers had favourable attitude towards livelihood diversification followed by less favourable (32%) and more favourable (26.7%). The data reveals that about 46.7 per cent of them are moderately diversified followed by highly diversified (30.6%) and less diversified (22.7%). The major livelihood activities practiced by the farmers are agriculture (98.66%), animal husbandry (82.66%), horticulture (64%), agriculture labour (52%), formally employed (48%) and poultry (33.33%). Majority of the farmers adopted four activities (28%) for their livelihood followed by five (24%), three (21.33%), six and more (18.67%) and two (8%) activities. The independent variables such as age, education, farming experience, economic motivation, management orientation, innovative proneness, mass media participation and extension participation annual family income, awareness about livelihood diversification had significant relationship with the attitude of farmers towards livelihood diversification and their extent of diversification. The R^2 value pointed out that all the 20 independent variables contributed to the extent of 77.54 per cent of variation in the attitude of farmers towards livelihood diversification and 79.06 per cent of variation in extent of livelihood diversification among farmers. Majority of the farmers were motivated by the friends (70.67%) and neighbours (38.00%). The major training needs are farm production planning and time management (98.67%) followed by optimum use of resource (95.33%), employment opportunities in various diversification activities (92.00%) and developing entrepreneurial capabilities (88.67%). The major constraints faced by the farmers were lack of water resources, lack of market facilities for the products, insufficient government incentives, inadequate knowledge about diversification and lack of adequate natural resources for livelihood diversification.

Ayurveda And Allied Sciences Perspective On Climate Change And Wellbeing**Veena.P. Reghunathan***Sanskriti University Mathura, U.P., India.***ABSTRACT**

Ayurveda, the ancient Indian traditional system of medicine, allied sciences and Indian culture indeed acknowledges the interconnectedness of human health, environmental balance, and climate change. All ancient sciences accept Loka purusha siddhantha, triguna theory, pancha maha bhoota theory etc. According to Ayurveda, epidemic factors can be related to imbalances in the natural environment, including: In Ayurveda, the concept of **Janpadodhwamsa** (epidemiology) highlights the importance of environmental factors, lifestyle, and social determinants in the emergence and spread of epidemics.

1. **Prithvi (Earth):** Soil pollution, degradation, or imbalance can contribute to epidemics.
2. **Jala (Water):** Water pollution, contamination, or imbalance can lead to epidemics.
3. **Vayu (Air):** Air pollution, imbalance, or changes in atmospheric conditions can contribute to epidemics.
4. **Agni (Fire) and Teja (Light):** Sometimes, Ayurveda also mentions the impact of changes in temperature, sunlight, or fire-related factors on health.

These elements are interconnected, and their imbalance can affect human health, leading to epidemics. When *adharma*/unrighteous living prevails, the natural world suffers. The imbalance affects the purity of land, water, air, and the seasonal rhythms, resulting in pollution and disruptions in the bio-energy field. This, in turn, can lead to ultimately triggering outbreaks of epidemics.

Ecosystems are responding to climate change through:

1. **Species distribution shifts:** Changes in range and migration patterns.
2. **Phenological changes:** Shifts in life cycle timing, disrupting synchrony between species.
3. **Ecosystem disruptions:** Increased extreme events, changes in structure and function.
4. **Biodiversity consequences:** Extinction risk, changes in community composition.
5. **Adaptation strategies:** Ecosystem-based adaptation, assisted migration.

These changes impact ecosystem health, resilience, and biodiversity.

Ayurveda attributes epidemic outbreaks to past actions or karma also, emphasizing the importance of living in harmony with nature and following *dharma* (righteous living).

Ayurveda offers a holistic approach to addressing climate change and wellbeing by emphasizing the interconnectedness of human health and the environment. Its principles and practices provide a framework for building climate-resilient health, promoting sustainable living, and fostering environmental stewardship.

Climate Change Mitigation: Ayurveda's focus on natural remedies, sustainable practices, and environmental conservation can help mitigate the impacts of climate change.

Holistic Health: Ayurvedic practices like Dinacharya (daily routine) and Ritucharya (seasonal adaptation) promote health and wellbeing by aligning human life with natural rhythms.

Sustainable Living: Ayurveda's emphasis on local, seasonal, and organic produce, as well as mindful consumption, supports eco-friendly living and reduces carbon footprint.

Environmental Stewardship: Ayurvedic principles like Ahimsa (non-violence) and Aparigraha (non-possessiveness) encourage minimalism, reducing waste and promoting sustainability^{1 2}.

Ayurveda can contribute significantly to achieving the United Nations' Sustainable Development Goal-03 (Good Health and Wellbeing) by:

- Preventing diseases through primordial prevention and treating curable diseases
- Promoting healthy lifestyles and wellbeing for all at all ages
- Reducing illnesses and deaths from hazardous chemicals and pollution
- Supporting holistic health and sustainable living practices³

Ancient Indian wisdom and Ayurveda suggest that practices like fasting (Upavasa), righteous living (Dharma), and nature-friendly living can promote balance, sustainability, and wellbeing. These practices can reduce carbon footprint, improve mental and physical health, increase sense of purpose, and enhance connection with nature, ultimately contributing to a more resilient and sustainable future for individuals and the planet.

By integrating Ayurvedic principles and practices into our daily lives, we can foster a more sustainable and resilient future for human health and the environment.

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**Comparative performances of intercrops in *Gmelina arborea* based agrisilvicultural system
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ABSTRACT

A field experiment was conducted during *kharif* and *rabi* season of 2016-17 and 2017-18 Ranchi, Jharkhand, India. The yield attributes of intercrops (number of pods/siliquea per plant, number of pod clusters per plant, pod/siliquea length, pod diameter, number of seeds per pod/siliquea, weight of seeds per pod/siliquea and test weight) and yield (grain yield, straw yield, biological yield and harvest index). The data on yield attributes revealed that number of pods/siliqueas per plant, number of seeds per pod/siliquea, number of pod clusters per plant, pod/siliquea length, pod diameter, weight of seeds per pod/siliquea and test weight of arhar, cowpea, green gram and mustard was recorded higher in case of sole crop than when intercropped with gamhar in *kharif* and *rabi* seasons of 2016-17, 2017-18 and in pooled data. Number of pods/siliqueas per plant, number of seeds per pod/siliquea, number of pod clusters per plant, pod/siliquea length, pod diameter, weight of seeds per pod/siliquea and test weight of arhar, cowpea, green gram and mustard was also recorded higher in 2017-18 as compared to 2016-17. Grain yield, straw yield, biological yield and harvest index of arhar, cowpea, green gram and mustard was recorded higher in case of sole crop than when intercropped with gamhar in *kharif* and *rabi* seasons of 2016-17, 2017-18 and in pooled data. Grain yield, straw yield, biological yield and harvest index of arhar, cowpea, green gram and mustard was also recorded higher in 2017-18 as compared to 2016-17.

Keywords: Intercrops; yield attributes; yield; agrisilviculture; agroforestry

**Design, Synthesis, In-Vitro And In-Silico Screening Of Novel Pyrrole Derivatives Bridged With Fused Triazolo-Thiadiazole Moiety As Potent Anti-Tubercular Agents
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ABSTRACT

Background: Tuberculosis (TB), caused by *Mycobacterium tuberculosis*, is a chronic infectious airborne disease. Anti-tubercular drugs (ATDs) are essential for treatment. Though the drugs are available for treating TB, due to existence of XDR and MDR-TB strains, there is an urgent need for developing potent anti-TB. In this study, the novel Pyrrole moieties were synthesized and examined as potential therapeutic drugs for the treatment of TB, which aims to address the limitations of existing anti-tubercular drugs.

Objective: To synthesize novel pyrrole derivatives as potent anti-TB agents.

Methodology: Titled compounds were synthesized by the reaction between Pyrrolyl-phenyl amino triazole thiol and substituted aromatic acids in phosphoryl chloride under controlled reflux conditions. The synthesized compounds were characterized by spectral characterization and screened In-vitro by Microplate Alamar Blue assay (MABA) method against tuberculosis H₃₇ RV strain. Compounds are further screened by in-silico method to know their binding and druggability.

Result: Among the series PR-1A, PR-1B, PR-1C, PR-1E, PR-1F, and PR-1L exhibited potent anti-tubercular activity.

Conclusion: The experimental findings indicate that the pyrrole derivatives with slight structural modification can potentially produce new effective drugs for treating tuberculosis.

Keywords: *Pyrrole, tuberculosis; antitubercular activity; drug resistance; MABA; H₃₇ RV strain; mycobacterium tuberculosis*

Climate Change and Its Impacts on Crop–Weed Dynamics: Challenges and Adaptation Strategies **Sunil Kumar Yadav^{1,2}**

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ABSTRACT

Climate change has emerged as one of the most critical challenges facing global agriculture in the 21st century, with profound implications for crop production and weed flora dynamics. Key drivers, including rising atmospheric temperatures, elevated CO₂ concentrations, altered rainfall distribution, and the increased frequency of extreme weather events, are reshaping agro-ecosystems in complex ways. Elevated CO₂ enhances photosynthetic efficiency, biomass accumulation, and water-use efficiency, particularly in C₃ weeds, which may gain a competitive advantage over many crop species. Temperature rise accelerates weed germination, seedling establishment, and flowering, often leading to prolonged growing seasons and overlapping weed–crop growth cycles. Changing precipitation regimes influence soil moisture availability, creating conditions that may favor drought-tolerant or flood-tolerant weed species, while facilitating the spread of invasive alien weeds into new agro-climatic regions. These shifts disrupt traditional crop–weed competition balances, reduce crop yields and quality, and undermine the effectiveness of conventional weed control measures. Furthermore, herbicide efficacy and weed resistance patterns may be altered under changing climatic conditions, complicating management efforts. Addressing these emerging challenges requires the integration of climate-resilient crop varieties, adaptive weed management practices, improved forecasting systems, and sustainable agronomic strategies. A comprehensive understanding of crop–weed–climate interactions is therefore essential to ensure long-term agricultural productivity and global food security.

Keywords: *Climate change; Crop–weed interaction; CO₂ enrichment; Weed flora shift; Invasive species; Sustainable weed management.*

Management of major pests of Sunflower Using novel Insecticides

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ABSTRACT

Sunflower *Helianthus annuus* is among India's most important crops widely valued for its edible oil and seeds rich in protein and vitamins like A B E and K. In India sunflower is traditionally grown in all the states but among these the major states are Karnataka Maharashtra Telangana and Andhra Pradesh in the present time its cultivation is extended into the new areas like Haryana Punjab up Gujarat, Tamilnadu, Odisha, Madhya Pradesh and Rajasthan. This crop is widely adoptable to many soil types as well as to all the seasons like *Kharif*, Rabi and even also in summer or spring season therefore according to the estimates of 2023- 24 and it occupies area of approximate 1.5 lakh hectares with production of around 1.6 lakh tonnes and productivity of 1061 kgs per hectare in India. Among the states Karnataka tops the area under sunflower which contributes about 42.50% of the area total production but the overall productivity of sunflower is higher in case of the Telangana which accounts for a average productivity of 1691 kgs per hectare in case of Maharashtra the productivity of sunflower

is lowest among the all sunflower growing state which is around 350 kg/ ha (Anonymous 2023-24). However analysis also show the negative compound and all annual growth rate in area and production of sunflower in western Maharashtra Marathwada and vidarbha region of Maharashtra state. Anonymous 2022-23 Over 90% of India's total acreage and 78% of its total production are grown in the states of Andhra Pradesh, Karnataka, Maharashtra, and Tamil Nadu (Chander Rao et al., 2015). According to Shankergoud et al. (2006), oilseeds comprise 10% of the overall value of all agricultural products, 14% of the country's gross cultivated area, and 5% of the gross national GDP, making them the second-largest agricultural commodity after cereals. The most probable reasons for the lowest productivity of the sunflower is the attack of the insect pest and diseases. The environment of sunflowers is linked to a varied collection of both useful and destructive insect species. *Agrotis* spp. cutworms, sucking pests, plant and leaf hoppers (*Amrasca biguttula biguttula* Ishida, *Empoasca* spp.), thrips (*Thrips palmi*), whiteflies (*Bemisia tabaci* Gennadius), defoliators (*Spilosoma obliqua* Walker, *Spodoptera litura* Fabricius, and *Plusia orichalcea* Fab.), and capitulum borer (*Helicoverpa armigera* Hubner) are all significant pests of economic concern. distinct pests harm distinct areas of the sunflower plant at different periods of phonological development. Roots and budding seedlings are harmed by soil insects. Sucking pest and defoliators reduce food supplies. Pests that injure inflorescences, such as *H. armigera*, kill developing seeds and floral parts. (Basappa, 1998).

Adoption of integrated pest management (IPM) in India integrates cultural tactics (crop rotation, intercropping, border and trap crops, optimal planting dates), mechanical control (egg mass removal, trap and light traps), biological measures (predators, parasitoids, neem extracts, Bt, NPVs), seed treatments (imidacloprid, metalaxyl, Trichoderma), and judicious, threshold-based chemical use. Therefore present study is undertaken with following objective

1. To identify suitable insecticide to manage major pest of Sunflower
2. To increase yield of sunflower with least environmental cost.

Methodology

An experiment to evaluate the chemical insecticides against major pests of Sunflower was carried out in randomized block design with eight treatments and three replication during Kharif 2005, 2006, 2007 & 2012. The observations on pest incidence, predators and pollinators were recorded one day before imposing treatment and three and seven days after imposing the treatments from five randomly selected plants of each plot. Data so collected was subjected to statistical analysis and results were interpreted.

Head borer: Randomly 5 plants were selected, % seed damage head and the larval number flower bud - 1 and flower head-1 were recorded.

Defoliators: No. of Defoliator population i.e. *Spilosoma obliqua* Walker, *Spodoptera litura* Fabricius, and *Plusia orichalcea* Fab were recorded by 5 randomly selected plants, counting the total number of larvae. Using these data, the mean population per plant and mean per cent was worked out and further analysis were made.

Results

For the control of major pest of sunflower (head borer and defoliators) the treatment of Spinosad 45 SC @ 0.3ml / lit was found effective and was at par with the treatment of Indoxacarb 14.5 SC @ 1ml/lit. The data presented in the Table 1 to 4 revealed that the highest seed yield was recorded by the treatment of Spinosad 45 SC @ 0.3ml / lit (i.e. 1416 kg/ha) followed by the treatment of Indoxacarb 14.5 SC @ 1ml/lit (1401 kg/ha) and both the treatments were at par with each other.

Conclusion

For the effective management of major pest of Sunflower i.e. Head borer and Defoliators spraying of Indoxacarb 14.5 SC @ 10ml / 10lit or Spinosad 45 SC 3ml / 10lit of water immediately after initiation of infestation is recommended.

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Transformation of Agricultural Systems through Plant-Based Food Pathways: A Sustainability Perspective

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ABSTRACT

This study explores the transformation of agricultural systems through plant-based food pathways, with a focus on the emerging entrepreneurial opportunities linked to sustainability transitions. As the agri-food sector confronts mounting environmental pressures ranging from climate change and land degradation to biodiversity loss, plant-based food systems are gaining traction as both a climate-resilient solution and a driver of innovation. The study analyzes how the shift toward plant-based diets and production models opens new markets for sustainable agri-entrepreneurship, particularly in areas such as alternative proteins, legume-based cropping systems, plant-derived inputs, and value-added processing. It highlights the role of startups and small-scale enterprises in accelerating this transition, supported by evolving consumer demand, advances in food technology, and policy incentives. The study also considers systemic barriers to entry, including infrastructure gaps, access to finance, and supply chain constraints, and proposes enabling conditions for inclusive and scalable innovation. Ultimately, the study positions plant-based food entrepreneurship as a critical lever in reconfiguring agricultural systems toward greater sustainability, equity, and economic opportunity.

Keywords: *Plant-based food; Sustainable agriculture; Alternative proteins; Sustainable agri-startups; entrepreneurship*

α -amylase inhibitor from *Amaranthus spinosa* with potential for controlling insect *Callosobruchus chinensis* L.(Coleoptera)

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ABSTRACT

This study investigated the phytochemical constituents and alpha amylase inhibitory activity of water, methanol, ethyl acetate and dichloromethane leave, root and stem extracts of *Amaranthus spinosus*. Plants have evolved a certain degree of resistance through the production of defence compounds, which may be aprotic, e.g. antibiotics, alkaloids, terpenes, cyanogenic glucosides or proteic, e.g. chitinases, beta-1,3-glucanases, lectins, arcelins, vicilins, systemins and enzyme inhibitors. Standard methods were used for the identification of cardiac glycosides, phenolic compounds,

flavonoids, anthraquinones, and alkaloids. The enzyme inhibitors impede digestion through their action on insect gut digestive alpha-amylases and proteinases, which play a key role in the digestion of plant starch and proteins. standard methods were used for the identification of phenolic compound, flavonoids, alkaloids, cardiac glycosides, and anthraquinone. The extract of the solute in flow rate 1 ml/min at the wavelength 250nm and methanolic extract shows the alpha amylase inhibitory activity. The natural defences of crop plants may be improved through the use of transgenic technology. *C. chinensis* feeding of extract α -AI to *C. chinensis* significantly reduced egg laying capacity, number of adults emerged and average weight of male and female insects.

Keyword: *alpha amylase inhibitor; flavonoids; Callosobruchus chinensis; phenolic compounds*

Green, Smart, Resilient: Transforming Urban Infrastructure for a Changing Climate

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ABSTRACT

Urban areas today face unprecedented climate challenges, from heatwaves and floods to extreme weather events, driven by rapid urbanization and rising populations. Studies show that these events are increasing in frequency and severity, making climate-resilient infrastructure more crucial than ever (IPCC, 2023). Such infrastructure not only protects cities physically but also strengthens social and economic resilience by safeguarding communities and essential services. A proven approach is the integration of green infrastructure (GI) including urban parks, green roofs, permeable pavements, and water-sensitive urban designs. GI helps manage stormwater, reduces urban heat island effects, and improves air quality. For example, research in Ahmedabad found that strategically placed parks combined with reflective pavements significantly lowered ambient temperatures, demonstrating practical benefits (Times of India, 2023). Implementation, however, faces challenges, especially in low- and middle-income cities, where financial, institutional, and technical constraints exist. Experts recommend adopting inclusive, adaptable, and health-centered planning frameworks that emphasize community participation, policy alignment, and impact assessments to enhance effectiveness (Springer, 2023). In summary, climate-resilient urban infrastructure requires a multifaceted approach that blends innovation, policy support, and stakeholder engagement. By building green, smart, and resilient cities, we can safeguard urban populations, enhance sustainability, and future-proof our urban environments against the escalating impacts of climate change.

Keywords: *Climate change; Climate-resilient infrastructure; Green infrastructure (GI); Climate adaptation*

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Assessment Of Manually Operated Fertilizer Broadcaster For Top Dressing Of Urea In Rice

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ABSTRACT

Rice is a major crop of Bihar grown during Kharif season. In general practice, fertilizer application is done manually by broadcasting method. Hand broadcasting of fertilizer is time and labour consuming and it results improper distribution and stripped broadcasting of fertilizer. Use of manually operated fertilizer broadcaster for top dressing of urea will cause better distribution of fertilizer in rice. Narode *et al.* (2015) worked on three-wheeled manually operated fertilizer spreader to enhance uniform application while minimizing input wastage and labor effort, making it suitable for economically weaker farmers, Chaudhari *et al.* (2018) worked on design and development of manually operated fertilizer spreader. Kumar *et al.* (2024) revealed that fertilizer spreader machine takes less time for fertilizer spreading as compared to the traditional hand broadcasting method. This is useful for small farm holding farmers since cost of manually (hand) operated fertilizer broadcaster machine is very less as compared to automatic machine and it do not need to carry heavy bags or pumps on their shoulders and it performed effective fertilizer spreading in the field. The efficiency of work is boosted by utilizing this machine. It also cuts down time of fertilizing, fertilizer wastage during the process along with reduction in labor cost as compare to traditional broadcasting method. Only one person can operate the machine by hanging it on the two shoulders with the help of belt.

Keeping this in view, a study was conducted at farmers' field in Jehanabad, Bihar on assessment of fertilizer broadcaster for top dressing of urea in rice. The present work aims to determine the parameters - Field Capacity (ha/hr), Time taken (hr/ha), Yield (q/ha), Net return (Rs. /ha) and B:C ratio.

METHODOLOGY

An on-farm trial was conducted at farmer's field in Jehanabad district of Bihar (India) during Kharif season 2020 and 2021 on "Assessment of manually operated fertilizer broadcaster machines for topdressing of urea in rice". Farmers of the district generally use traditional broadcasting method for urea application in rice that consumes more time and non-uniform application. In this study, manually (hand) operated fertilizer broadcaster machine has been used for top dressing of urea which costs Rs. 3000/- per unit. The field trial was conducted with 8 replications along with 0.4 hectare unit area in each replication for two consecutive years 2020 and 2021 having three technological options i.e. Technology option-I as Farmers Practice (TO-1): Hand broadcasting of recommended dose of Urea, Technology option-II (TO-2): Use of fertilizer broadcaster machine with 2.5 m spacing between two passes for application of recommended dose of Urea and Technology option-III (TO-3): Use of fertilizer broadcaster machine with alternate spacing of 2.5 m and 1.0 m between two passes for application of recommended dose of Urea. Rice var. R. Sweta was grown with recommended agronomical practices. Data on parameters such as Field Capacity (ha/hr), Time taken (hr/ha), Yield (q/ha), Net return (Rs. /ha) and B: C ratio was recorded for all the technological options.

RESULTS

Results of the study has been mentioned in Table-1 which indicated that during Kharif 2020, highest yield of Rice (44.2 q/ha) along with B:C ratio 2.22 was observed when manually operated fertilizer

broadcaster machine is used with 2.5 m spacing between two passes for application of recommended dose of urea (in TO-2) followed by TO-3 plots i.e. use of fertilizer broadcaster machine with alternate spacing of 2.5 m and 1.0 m between two passes for application of recommended dose of urea resulting yield of 42.5 q/ha and B: C ratio of 2.11 as compared to 41.5 q/ha yield with B:C ratio 2.03 in Farmer's practice plot (TO-1).

Table 1: Effect of top dressing of urea in rice through manually operated fertilizer broadcaster machine

Technology option	Field Capacity (ha/hr)		Time taken (hr/ha)		Yield (q/ha)		Increase in yield (%)		Net return (Rs. /ha)		B:C ratio	
	Khari f 2020	Khari f 2021	Khari f 2020	Khari f 2021	Khari f 2020	Khari f 2021	Khari f 2020	Khari f 2021	Khari f 2020	Khari f 2021	Khari f 2020	Khari f 2021
TO-1	0.3	0.25	3.3	4.0	41.5	42.2	-	-	38975	43368	2.03	2.12
TO-2	1.0	0.8	1.0	1.25	44.2	45.1	6.5	6.87	44970	50194	2.22	2.34
TO-3	0.8	0.65	1.25	1.53	42.5	43.6	2.4	3.31	41425	46684	2.11	2.23

During Kharif 2021, highest yield of rice (45.1 q/ha) along with B:C ratio 2.34 was also observed in TO-2 i.e. use of fertilizer broadcaster with 2.5 meter spacing between two passes for application of recommended dose of urea followed by TO-3 plots i.e. use of fertilizer broadcaster with alternate spacing of 2.5 meter and 1.0 meter between two passes for application of recommended dose of urea with 43.6 q/ha yield, B: C ratio of 2.23 as compared to 42.2 q/ha yield with B:C ratio 2.12 in Farmer's practice plot (TO-1).

Thus, technological option TO-2 i.e. use of fertilizer broadcaster machine with 2.5 m spacing between two passes for application of recommended dose of urea, consumed minimum time with maximum field capacity as well as maximum rice yield and B: C ratio. Labour saving in the range of 6 to 8 per hectare was also recorded besides uniform distribution of fertilizer and drudgery reduction.

CONCLUSION

On the basis of present study, it has been concluded that use of manually (hand) operated fertilizer broadcaster machine with 2.5 meter spacing between two passes for application of recommended dose of urea i.e technological option 2 (TO-2) performed best in terms of time taken, field capacity, yield, net return and B:C ratio in Rice. Thus, considering all these parameters, use of manually operated fertilizer broadcaster machine is recommended for urea application in rice cultivation for efficient use as well as better distribution of fertilizer and saving of cost on labours.

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Assessment Of Different Methods Of Sowing For Lentil**Jeetendra Kumar¹, Muneshwar Prasad¹, Wajid Hasan¹, R.N. Singh² and R.K. Sohane²**¹*Krishi Vigyan Kendra, Jehanabad-804432, BAU, Sabour (Bhagalpur), India.*²*Bihar Agricultural University, Sabour (Bhagalpur)-813210, India.*

Lentil is a major pulse crop grown during *Rabi* season under rain fed conditions of Bihar including Jehanabad district. Generally, lentil is grown as un-irrigated crop in the residual soil moisture. It is grown in all types of soil from sandy to clay loam. It is best suited in well drained soil with moderate acidic condition for good yield. In traditional lentil sowing, farmers generally use broadcasting method in which they face high cost of cultivation and get lower yield. This method proved to be costly due to ploughing of field several times and it also cause delay in sowing as well as reduced availability of moisture in later stages of lentil crop. Minimum tillage / Zero tillage cultivation reduces cost of cultivation and conserves the soil moisture and the method is being followed in other parts of India. It not only conserves residual moisture but also reduces cost of cultivation thus zero tillage technique is used as conservation tillage. Yadav *et al.* (2013) worked on lentil cultivation by zero tillage system. Singh *et al.* (2015) advised to follow zero till practice for lentil sowing after un-puddle transplanted rice cultivation. Singh *et al.* (2019) evaluated the performance of zero till lentil in rice lentil cropping sequence. The present study was carried out with objective to find out effect of sowing methods on yield and economics of lentil cultivation.

MATERIALS AND METHODS

An on farm trial was conducted at farmer's field in Jehanabad district of Bihar (India) during *Rabi* season 2012-13 for assessment of different methods of lentil sowing to overcome the high cost of cultivation and to find out it's effect on yield and economics. The experiment was laid out with lentil var. Arun in randomized block design with 6 replications (no. of farmers) each having plot size of 0.25 hectare in 4 villages including NICRA (National Innovations on Climate Resilient Agriculture) Project village Sakrorha, Block-Modanganj along with three technological options: TO1- Broadcasting of lentil seed (Farmer's practice), TO2- Sowing of lentil by seed cum fert. drill and TO3- Sowing of lentil by Zero Till seed cum fert. drill. Lentil var. Arun was raised with full agronomical practices in which seed rate of 40 kg/ha was used. Lentil seed was sown by 11 row tractor drawn seed cum fertilizer drill (TO2) and zero till seed cum fertilizer drill (TO3) at 4-5 cm soil depth with row to row distance of 15 cm. In TO1, field was ploughed thrice with tractor drawn 9 row cultivator followed by one planking by wooden leveler and lentil seed was broadcasted manually. In TO2, field was ploughed in the same manner and lentil seed was sown by 11 row tractor driven seed cum fert. drill whereas in TO3, lentil seed was sown using 11 row zero till seed cum fertilizer drill. After maturity, crop was harvested manually by sickles. Data on cost of cultivation, yield, gross return, net return was calculated and benefit cost ratio was evaluated.

RESULTS AND DISCUSSION

Yield and economic parameters of lentil cultivation as influenced by different methods of lentil sowing have been presented in Table 1. It is inferred from Table 1 that TO3 performed best in terms of yield, net return as well as B:C ratio. Highest yield of 21.8 q/ha with B: C ratio of 6.95 was found in TO3 as compared to 20.6 q/ha yield with B: C ratio of 5.89 in TO2 and 18.2 q/ha yield with B: C ratio of 4.72 in TO1. Cost of cultivation was lowest as Rs.11800/- in TO3 followed by Rs. 13200/- in TO2 and recorded highest as Rs. 13500/- in farmer's practice plots on per hectare basis whereas per hectare net return of Rs. 70200/-, Rs. 64560/- and Rs. 50200/- was recorded in TO3, TO2 and TO1 (i.e. farmer's practice) treatments, respectively. Lentil sowing by zero tillage technology saved Rs. 1700/ha as cost of cultivation in comparison to TO1. TO3 gave significantly increased yield than other two treatments.

Table 1: Yield and economics of lentil as influenced by different methods of lentil sowing

Treatments	Yield (q/ha)	Cost of cultivation (Rs./ha)	Gross Return (Rs./ha)	Net Return (Rs./ha)	B:C Ratio
TO1- Broadcasting of lentil seed (Farmer's practice)	18.2	13500	63700	50200	4.72
TO2- Sowing of lentil by seed cum fert. drill	20.6	13200	77760	64560	5.89
TO3- Sowing of lentil by Zero Till seed cum fert. drill	21.8	11800	82080	70280	6.95
SEm ±	0.29	-	-	-	-
C.D (p=0.05)	0.92	-	-	-	-
CV (%)	3.53	-	-	-	-

Table 1 further depicted that 19.8 percent and 5.8 percent more yield was achieved in TO3 in comparison to TO1 and TO2, respectively. Pokhrel and Soni (2018) also reported reduction in production cost by 28 percent. Kumar *et al.* (2011) in their findings reported 25.4 percent increase in grain yield of lentil var. Arun under no till system in eastern Indo Gangetic Plain. Singh and Singh (2006) observed yield difference of 5.11 q/ha between zero till drill and conventional method of seeding of lentil along with highest output to input ratio of 4.45 in zero till drill condition.

CONCLUSION

Findings of the study indicated that sowing of lentil by zero till seed cum fertilizer drill has been found resource conserving technology and beneficial in terms of saving in cost of cultivation, significant increase in yield, net return as well as B: C ratio as compared to lentil sowing by seed cum fertilizer drill and traditional method of lentil sowing by broadcasting method.

Application of IT and Digital tools in Climate Studies

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ABSTRACT

The application of Information Technology (IT) and digital tools has revolutionized the field of climate studies, offering new avenues for data collection, analysis, modeling, and dissemination. Climate systems are highly complex, involving interactions between the atmosphere, hydrosphere, lithosphere, and biosphere. Traditional methods of climate monitoring often faced limitations in scale, speed, and accuracy. However, with the integration of digital technologies, climate research has advanced significantly in recent decades. Remote sensing and Geographic Information Systems (GIS) enable large-scale monitoring of land, water, and atmospheric parameters, providing high-resolution spatial and temporal data essential for understanding climate variability and change. Big data analytics and cloud computing allow the processing of vast climate datasets, improving predictions and supporting advanced climate models. Artificial Intelligence (AI) and Machine Learning (ML) techniques enhance forecasting accuracy by identifying hidden patterns and relationships in complex climate data. Digital communication platforms, mobile applications, and decision support systems further bridge the gap between climate research and policy-making by delivering real-time, location-specific climate

information to governments, industries, and communities. These tools aid in disaster preparedness, agricultural planning, resource management, and climate change mitigation strategies. Moreover, open-access climate databases and digital repositories foster international collaboration and transparency in climate research. Despite these advancements, challenges such as data integration, digital divide, cybersecurity, and high costs of advanced technologies persist. Addressing these concerns is essential to ensure equitable access and effective utilization of digital tools across regions. Overall, the application of IT and digital technologies provides powerful solutions for enhancing the accuracy, accessibility, and relevance of climate studies, ultimately supporting sustainable development and resilience in the face of global climate change.

Selective Detection and Removal of Toxic Compounds Using Molecularly Imprinted Polymers: Synthesis, Characterization, and Environmental Applications

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ABSTRACT

Molecularly Imprinted Polymers (MIPs) have emerged as promising synthetic materials engineered for the selective recognition of specific target molecules, offering robust alternatives to natural recognition systems such as antibodies and enzymes. This study focuses on the synthesis of MIPs tailored for the detection and removal of toxic compounds from environmental and biological matrices. MIPs were prepared using a bulk polymerization technique with methacrylic acid as the functional monomer, ethylene glycol dimethacrylate as the crosslinker, and various toxic compounds—including herbicides, insecticide and heavy metal ion complexes—as templates. The resulting polymers were characterized using FTIR, FE-SEM, BET, XRD, uv-visible spectroscopy and binding studies to evaluate their morphology, surface area, and imprinting efficiency. The synthesized MIPs demonstrated high selectivity, binding capacity, and stability under harsh conditions, making them effective for the extraction and sensing of trace-level toxicants. Applications were validated through integration with electrochemical sensor platforms, showing significant potential for environmental monitoring and food safety analysis. This work highlights the versatility and efficacy of MIPs as advanced materials for selective toxic compound detection, paving the way for their broader application in analytical and environmental chemistry.

Keywords: *Molecularly Imprinted Polymers (MIPs); Toxic Compound Detection; Environmental Monitoring; Functional monomer and Electrochemical Sensors*

Post-Harvest Technologies And Mechanisation For Profitability Neyi Megu

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ABSTRACT

Climate change is increasingly affecting post-harvest activities by causing higher losses and lowering the quality of agricultural produce. Extreme weather events, rising temperatures, and unpredictable rainfall patterns accelerate spoilage, promote pest attacks, and disrupt storage and transportation. These factors reduce farmers' income and threaten food security.

Adopting improved post-harvest technologies can help reduce these losses and increase profitability. Advanced drying and sorting systems ensure better quality control, while modern cold storage and drying facilities prevent microbial spoilage and nutrient loss. Mechanisation reduces labour dependence and improves efficiency.

In India, institutions and universities have introduced advanced and efficient methods. For example, the Central Food Technological Research Institute (CFTRI) has developed advanced parboiling and milling methods to reduce breakage and improve yield. The pressure parboiling method increases grain quality and storage life, while innovations from Jadavpur University offer energy-efficient, cost-effective processing techniques.

By adopting such technologies, we can minimise post-harvest losses, improve product quality, and achieve greater operational efficiency. This boosts farmer profitability while strengthening the nation's ability to cope with the adverse impacts of climate change.

Silicon Supplementation Solutions for Future Farming: From Fertigation to Nanotechnology in Boosting Yield and Resilience.

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ABSTRACT

The current global population of 8.1 billion is estimated to exceed 10 billion by 2050; for a growing global population, it is indeed important to prioritize food security. Silicon (Si), predominately as silica (SiO₂), constitutes 28% of the Earth crust. However, silicon availability in farmland does not exceed 10 mg L⁻¹ due to its insoluble form. Soil pH is one of the most important Si solubilities in soil solution. The intake of silicon as monosilicic acid (H₄SiO₄) by plants has been statistically shown to enhance growth and development under the various biotic and abiotic stress conditions. The molecular-level modulations triggered by Si supplementation under various stresses and the physiological improvement of plant growth and recovery from stress ultimately result in increased crop yields. Nutrient uptakes were significantly increased by the application of silicon fertigation compared to the control. Based on the results, it can be concluded that the fertigation of silicon at 200 kg-ha⁻¹ could be used to give the optimum grain yield in paddy. The inclusion of Si in modern farming systems like hydroponics techniques has been blooming across the globe. Nano-SiO₂ improves wheat seedling growth and tolerance of salt stress up to 80 mg Kg⁻¹ for soil application and 600 mg L⁻¹ for foliar spray. Silicon nanofertilizers boost plant resilience to stresses like salinity, drought, and pests by enhancing nutrient absorption and strengthening plant cell walls. The study explores some new technologies, like nano-silica, which can help release silicon more effectively, boost how plants absorb it, and promote sustainable crop production, particularly as climate conditions shift. [As](#) researchers continue to explore silicon role in plant biology, its potential applications in sustainable agriculture will have a fruitful outcome.

Keywords: *Silicon fertigation; Nano-silica; Abiotic stress tolerance; Paddy yield optimization*

Effect of dates of sowing and insecticide application frequency to manage leaf webber and capsule borer (*Antigastra catalaunalis*, Dup.) in sesame under changing climate scenario

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INTRODUCTION

Sesame or Til (*Sesamum indicum* L.), belonging to the family Pedaliaceae, is one of the world's oldest oilseed crops, cultivated for more than 3,000 years. In India sesame is mainly grown for its seeds that

contain high-quality oil (48-52%), protein (25%) and lignans, such as sesamin, sesamol and sesamol. Its production is challenged by many insect pests and diseases, among them leaf webber and capsule borer (*Antigastra catalaunalis*, Dup.) is one of the most destructive and cosmopolitan insect pests of sesame and causes up to 83% yield loss. For the management of these insect pests farmers is generally focusing the use of synthetic pesticides that may lead to contamination of seed with pesticides residues, environmental and health hazards, besides risking export embargo. To meet the growing demand in domestic as well as in international market, there is an urgent need to address an important matter of concern i.e., pesticide free sesame seed.

MATERIAL AND METHODS

A field experiment was conducted at the Experimental Farm of the Project Coordinating Unit on Sesame and Niger (ICAR), College of Agriculture, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur (Madhya Pradesh), during the *Kharif* season.

RESULTS AND DISCUSSION

The present investigation was conducted to determine optimum sowing time and insecticide application frequency for controlling *A. catalaunalis*. Among four different dates of sowings, the first date of sowing (30th June) recorded significant lowest population of leaf webber and capsule borer and lowest plant, flower and capsule damage by *Antigastra* as compared to other three dates of sowings. Among the combinations (dates of sowing and insecticidal application frequency), first date of sowing (30th June) combined with three foliar sprayings of NSKE 5% at 30, 50 and 70 DAS (D₁T₂) was found superior in respect to recorded the lowest larval population of *Antigastra* at 50 and 70 DAS with 0.20 and 0.13 larvae/plant respectively. Treatment D₁T₂ (30th June sown crop + three foliar sprayings of NSKE 5% at 30, 50 and 60 DAS) also recorded lowest flower (3.21%) and capsule damage (3.45%) caused by *Antigastra*. Among different dates of sowing the highest seed yield of 820 kg/ha was recorded with treatment D₂T₂ (15th July sown crop + three foliar sprayings of NSKE 5%) with BC ratio of 3.2 followed by D₁T₂ with 800 kg/ha with BC ratio 3.1.

Future Prospects of Certification and Seed Quality Control

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ABSTRACT

Seed quality testing is a fundamental process to assess the physical, genetic, physiological, and health attributes of seeds. The primary objective is to ensure that seeds are viable, free from contaminants, and capable of producing healthy plants. Testing involves parameters such as purity, moisture content, germination rate, Vigor, viability, and disease presence. These tests provide essential data for farmers and seed producers, enabling informed decisions about sowing and storage. Adherence to international standards, such as those set by the International Seed Testing Association (ISTA), ensures the reliability and uniformity of results across regions. Seed quality testing plays a pivotal role in agricultural productivity and sustainability. Seed certification is a regulatory process that guarantees the distribution of high-quality seeds that meet established standards. Certification provides a seal of quality, fostering trust among farmers and enhancing agricultural outcomes. By ensuring the use of certified seeds, the certification process contributes significantly to food security and sustainable agricultural practices. Testing evaluates key attributes like purity, germination, and vigour, while certification verifies compliance with legal and quality standards. Together, they reduce risks of crop failure, enhance yields, and facilitate international seed trade. The adoption of standardized protocols and advanced testing

techniques, including genetic marker analysis and pathogen screening, strengthens these processes. As agriculture faces challenges like climate change and food demand, seed testing and certification remain critical for resilience and innovation in crop production. This article explores the stages of seed quality testing, including sampling, physical and genetic purity tests, germination and vigor assessments, and pathogen detection, alongside the certification process that involves field inspections, laboratory evaluations, and tagging.

Keywords: *Seed Certification; Seed Quality; Seed Testing; Seed Vigor; and Genetic purity*

Augmenting potato seed tuber yield through nutrients management under hydroponic system

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ABSTRACT

Potato is one of the world's most significant non-cereal food crop, which helps to enhance the nation's food supply. The degradation of agricultural land, soil contamination and heavy use of nutrients is a prime hurdle to maintain the production and productivity of potato crop. In order to solve these problems, an experiment was conducted at the Agricultural Experimental Block of Shri Guru Ram Rai University in Dehradun to determine the optimal nutrient concentrations for hydroponically grown potato seed tubers. The experiment was conducted by using five different levels of macronutrient concentrations (10:10:10, 15:15:15, 20:20:20, 25:25:25 and 30:30:30 g/l NPK) with four replications in Randomize Block Design. Macronutrient was applied to plants at every eight days of interval. A constant concentration of micronutrients was provided to plants at an interval of fifteen days. The growth and yield parameters of potato plants were recorded to know the effect of different treatments. Findings indicated that the different macronutrient composition significantly affects the growth and yield of potato. The most of the morphological and seed tuber yield characters of potato like plant height, number of leaves, fresh weight, chlorophyll content and dry matter accumulation were recorded maximum with application of 25:25:25 g/l NPK. The treatment of 25:25:25 g/l NPK ratio showed the highest yield, achieving 318.57 grams per plant, demonstrating an effective balance between vegetative growth and tuber development. The studies effectively identify the optimal nutrient level for maximizing the growth and seed tuber yield of hydroponically grown potato seed tubers. The results demonstrate that among all treatments the application of 25:25:25 g/l NPK attributed to its balanced nutrient profile that supported higher vegetative growth and seed tuber yield of potato.

Keywords: *Hydroponics, potato; nutrients and yield*

Vertical Farming a Sustainable Model for Urban Entrepreneurship

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ABSTRACT

Horticultural crops, including fruits, vegetables, spices, and ornamentals, are critical for nutritional security, farmer livelihoods, and agri-based entrepreneurship. In India, horticulture production reached 355.25 million tonnes in 2023–24 from 28.54 million ha, with fruits and vegetables accounting for over 85% of the output. However, conventional open-field cultivation faces constraints such as limited land availability, seasonal dependence, pest and disease pressure, and post-harvest losses of 20–30%, particularly for perishable crops.

Vertical farming, integrated with controlled-environment agriculture (CEA), offers an innovative, resource-efficient solution to these challenges. Crops are grown in multi-tier systems using hydroponics,

aeroponics, or aquaponics under precisely regulated conditions of light, temperature, humidity, and nutrient supply. Such systems can achieve 3–5 times higher yields per unit area compared to open-field farming, with water savings of up to 90–95% and zero pesticide use. For example, leafy greens yield 60–100 kg·m⁻²/year in vertical farms versus 20–25 kg·m⁻²/year conventionally, while cherry tomatoes produce 35–40 kg·m⁻²/year compared to 10–12 kg·m⁻²/year.

Economic analysis shows that a 60 m² vertical farm cultivating high-value horticultural crops can generate ₹8–10 lakh annual gross income, with net profit margins of 40–50% and a payback period of 18–24 months, especially when marketed directly to premium urban outlets. Additionally, proximity to consumers reduces “food miles” and post-harvest losses to below 5%, enhancing product freshness and market value.

Beyond profitability, vertical farming supports sustainable urban food systems, inclusive entrepreneurship, and climate resilience. It creates opportunities for start-ups, women’s self-help groups, and youth entrepreneurs while reducing agriculture’s environmental footprint. This study highlights vertical farming as a scalable, technology-driven approach to boost productivity, profitability, and sustainability in horticulture, positioning it as a key component of future urban and peri-urban agriculture.

Keywords: *Vertical farming; Horticultural crops; Controlled-environment agriculture; Hydroponics; Urban entrepreneurship; Sustainability*

Optimization of fertilizer levels for the submergence tolerant rice culture

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ABSTRACT

Climate change scenarios are predicting increases in future and intensities of floods, especially in the tropics and subtropics. Short-term submergence, mostly for 1-2 weeks due to excessive rainfall and seasonal flash-floods during the rainy season negatively affects the rice production in flood prone and rain-fed lowland areas of Asia. New submergence-tolerant culture has been developed to improve rice production in flood-affected areas. In this context, the field experiments were conducted in the sandy loam soil of Pandit Jawaharlal Nehru College of Agriculture and Research Institute, Karaikal, U.T. of Puducherry, India to optimize the fertilizer levels for the submergence tolerant rice culture during *rabi*, 2021 and 2022. The experiment was laid out in a split plot design and the treatments were replicated thrice. The rice cultivars *viz.*, KR16024 (preleased culture) and ADT 46 (check) and establishment methods *viz.*, SRI and Conventional planting were assigned to main plots, while fertilizer levels *viz.*, absolute control, 75% RDF, 100% RDF, 125% RDF and 150% RDF were tested as sub plots. The recommended fertilizer dose of 150:50:50 kg N:P₂O₅:K₂O was adopted. The results of the present investigation revealed that the rice culture KR16024 under SRI registered significantly more grain yield of 6117 kg ha⁻¹, but it was comparable with that of ADT 46 under SRI (6020 kg ha⁻¹). Among the fertilizer levels, 125 per cent of recommended dose of fertilizer (RDF) recorded significantly more grain yield (6187 kg ha⁻¹) and was comparable with application of 100% (5968 kg ha⁻¹). Based on the results of the present investigation, it is concluded and recommended that 150:50:50 kg N: P₂O₅: K₂O ha⁻¹ (100% RDF) may be applied to the pre-released rice culture KR16024 under SRI and conventional planting for realizing more grain yield during *rabi* in sandy loam soil of Karaikal region.

Keywords: *Cultivars; Establishment methods; Fertilizer levels; Productivity and Rice*

Entrepreneurship and the Environment: A Critical Examination of the Sustainability of Entrepreneurship Activity**Mohd Umar Farukh***Department of Commerce, AMU, Aligarh, India.***ABSTRACT:**

Entrepreneurship is widely celebrated as a driver of economic growth and innovation, but its relationship with environmental sustainability has become a subject of critical concern. This paper examines the nexus between entrepreneurship and the environment, evaluating whether entrepreneurial activity is contributing to sustainable development or exacerbating ecological challenges. We review the concept of sustainable entrepreneurship – entrepreneurial ventures that integrate economic, social, and environmental goals – and discuss its theoretical underpinnings and definitions. Drawing on recent literature and data, we explore the positive potential of entrepreneurship to advance environmental solutions (such as clean energy and waste management innovations), as well as the negative impacts of unchecked entrepreneurial growth on resource consumption and emissions. The analysis includes a global perspective with a focus on India, one of the fastest growing entrepreneurial ecosystems, to illustrate how sustainable entrepreneurship is emerging in practice and what challenges it faces. Findings suggest that while entrepreneurship can be a catalyst for environmental innovation and sustainability, this outcome is not guaranteed – in fact, conventional high-growth entrepreneurship often correlates with increased environmental pressures. Practical implications include the need for supportive policies, funding mechanisms, and educational initiatives to foster an ecosystem in which entrepreneurs incorporate sustainability principles. We conclude that achieving truly sustainable entrepreneurship requires reorienting entrepreneurial activity toward the “triple bottom line” of economic, social, and environmental value creation, ensuring that entrepreneurial growth does not come at the cost of our planet’s health.

Voices of the Unheard: Women Farmers Confronting Climate Change in the Indian Sundarbans
Anuska Roy¹, Supriya Ghorui^{1,2}¹*School of Agriculture and Rural Development, Ramakrishna Mission Vivekananda Educational and Research Institute, Narendrapur, Kolkata, India.*²*School of Gender and Women Studies, Indira Gandhi National Open University (IGNOU), Maidan Garhi, New Delhi, India.***ABSTRACT**

Women constitute the backbone of Indian agriculture, contributing significantly as cultivators, laborers, and primary food producers. According to recent estimates, nearly 84% of rural women engage in agriculture, yet they own barely 12–14% of landholdings, which severely limits their autonomy and bargaining power.

The Indian Sundarbans, a fragile coastal ecosystem, is among the most climate-vulnerable regions in India, with women farmers disproportionately bearing its adverse impacts. This study investigates the challenges faced by women farmers in the coastal saline zones of South 24 Parganas and documents their adaptation strategies amidst recurrent climatic hazards. Data were collected from 100 women farmers across Basanti and Kultali blocks using semi-structured interviews, Focus Group Discussions (FGDs), and Participatory Rural Appraisal (PRA) methods. Narrative analysis and the Analytical Hierarchy Process (AHP) were employed to examine risk perceptions, challenges, and to prioritize adaptation measures.

Findings reveal that women farmers face multiple overlapping challenges, including increased workload and change in gender-roles due to male out-migration, frequent crop failures, livestock mortality, water scarcity, and lack of institutional and financial support. Recurrent floods (25.91%), cyclones (23.06%), erratic rainfall (16.32%), and rising temperatures (8.29%) exacerbate soil degradation and livelihood insecurity. With limited land ownership and persistent wage inequality, women's decision-making power remains severely constrained, further deepening their vulnerability to climate stress.

A total of 24 adaptation strategies which are recommended by climate researchers, extension organisations (which are working in Sundarbans areas) and progressive farmers, were recorded across agriculture, livestock, fishery, and non-farm sectors. AHP analysis identified the most significant agricultural strategies as adoption of climate-resilient crop varieties (0.1270). In livestock, timely vaccination (0.045) and shifting from large to small ruminants (0.032) emerged as important. In fisheries, tilapia cultivation (0.048) ranked highest, while non-farm coping strategies included distress migration (0.070), switching to alternate livelihoods (0.068).

The study concludes that women farmers of the Sundarbans demonstrate remarkable resilience by adopting diverse strategies across sectors. However, their adaptive capacity is systematically constrained by wage disparity, lack of land rights, unequal resource access, and limited decision-making power. To strengthen resilience, there is an urgent need for gender-responsive climate policies, equitable land reforms, financial inclusion, and targeted institutional support. Multi-stakeholder collaboration is essential to empower women farmers and secure sustainable livelihoods in the climate-vulnerable Sundarbans.

Keywords: *Climate Change; Women Farmers; Indian Sundarbans; Wage Disparity; Land Rights; Adaptation Strategies; Analytical Hierarchy Process*

Climate Change and Its Effects on Crop and Environment

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ABSTRACT

Climate change is a global phenomenon that poses serious threats to crop production and the environment. Increasing atmospheric CO₂, rising temperatures, erratic rainfall, frequent droughts, and extreme climatic events have direct and indirect impacts on agricultural systems. Crops experience altered growth duration, changes in phenology, reduced pollination efficiency, nutrient imbalances, and yield instability. Some crops may benefit temporarily from elevated CO₂, but heat stress, water scarcity, and pest-disease outbreaks often offset these gains.

The environment is equally affected as climate change accelerates soil erosion, depletes organic matter, disturbs nutrient cycling, and reduces water-use efficiency. Shifts in weed flora, expansion of invasive species, and altered pest and disease dynamics further challenge sustainable crop production. Environmental stress also increases greenhouse gas emissions from agriculture, creating a feedback loop that intensifies climate change.

Agronomy offers solutions through climate-smart approaches such as conservation agriculture, precision nutrient and water management, integrated crop-weed-pest management, use of stress-tolerant crop varieties, and promotion of sustainable land-use systems. Adapting these practices is essential to safeguard both crop productivity and environmental sustainability in the face of a changing climate.

Keywords: *Climate change; Crop production; Environment; Sustainable agronomy; Climate- smart practices*

Storage and quality attributes of ozone fumigated table grapes in comparison with existing technologies**Suneel Subray Hegde^{1,2*}, M.D. Jameel Jhalegar², Viresh Mallayya Hiremath², Sateesh Pattepur², Abdul Kareem. M² and Kishorkumar G. K²**¹*Division of Post-Harvest Technology and Agricultural Engineering. ICAR - Indian Institute of Horticultural Research, Hessaraghatta, Bengaluru, Karnataka, India.*²*University of Horticultural Sciences, Bagalkot, Karnataka, India.***ABSTRACT**

Table grapes are among the most widely consumed fruits globally, valued for their sensory qualities and nutritional value. However, postharvest deterioration remains a significant challenge during cold storage. This study evaluated the effectiveness of ozone fumigation (10, 15 and 20 minutes), sulphur dioxide fumigation (2500 ppm), grape guards and sodium metabisulphite powder (1g/kg grapes) on disease incidence and physico-chemical quality parameters of Manik Chaman grapes stored at $5 \pm 2^\circ\text{C}$ and 85–95% relative humidity for 70 days. All treatments, except sodium metabisulphite powder and the untreated control, successfully suppressed disease development, with zero incidence observed throughout the storage period. Among them, 20-minute ozone fumigation proved to be the most effective, achieving the maximum shelf life (70 days), while retaining the highest berry firmness (4.20 N) and titratable acidity (0.70%) and exhibiting the lowest physiological weight loss (13.05%). Furthermore, it received the highest scores in sensory evaluations. These findings suggest that 20-minute ozone fumigation offers an effective, eco-friendly alternative for postharvest disease control and quality retention in table grapes, making it a promising technology for commercial cold storage applications.

Keywords: *Manik Chaman; Ozonation; fruit quality; sulphur dioxide; grape guard; post-harvest spoilage*

Digital Eyes on Fresh Produce: Hyperspectral Imaging in Action**Suneel Subray Hegde^{1*}, Kishorkumar G K², Preethi P¹ and Vijay Rakesh Reddy S¹**¹*Division of Post Harvest Technology and Agricultural Engineering. ICAR - Indian Institute of Horticultural Research, Hessaraghatta, Bengaluru, Karnataka, India*²*University of Horticultural Sciences, Bagalkot, Karnataka, India.***ABSTRACT**

Hyperspectral imaging (HSI), also known as chemical imaging, is an emerging digital technology combining imaging and spectroscopy to provide simultaneous spatial and spectral information. Traditional postharvest quality monitoring methods are slow, destructive, and costly, limiting efficiency in high-throughput food supply chains. In contrast, HSI enables real-time, non-destructive, and precise evaluation of product quality, safety, authenticity, and labelling compliance. Advances in sensor design, lower equipment costs, and faster data processing have positioned HSI as a transformative tool for agri-food enterprises. By capturing detailed spectral data across wide wavelength ranges, HSI supports automatic grading, accurate nutritional profiling, and rapid decision-making. Beyond technical advantages, the technology opens new avenues for entrepreneurship: startups and agritech firms can develop portable HSI systems, integrate them with artificial intelligence for predictive analytics, and deliver value-added services to packhouses, exporters, and retailers. HSI enables optimized quality control, reduced food losses, and compliance with strict regulations, fostering green and sustainable entrepreneurship while enhancing consumer trust. Its integration into digital supply chains exemplifies

how technology-driven business models can accelerate growth, create opportunities for knowledge-based enterprises, and advance the shift toward safer, superior-quality food systems.

Use Of Citrus In Boosting Immunity**Deepak S Kore, Kishorkumar G K and Abhishek***University Of Horticultural Sciences, Bagalkot, Karnataka, India.***ABSTRACT**

Citrus fruits, including oranges, lemons, limes and grapefruits, are rich sources of bioactive compounds that play a vital role in supporting and enhancing the immune system. They are particularly abundant in vitamin C (ascorbic acid), a potent antioxidant known to stimulate the production and function of white blood cells, enhance epithelial barrier function and reduce oxidative stress caused by pathogens. Additionally, citrus fruits contain flavonoids, carotenoids and essential oils that exhibit anti-inflammatory, antimicrobial and antiviral properties, contributing to improved immune resilience. Regular consumption of citrus has been linked to reduced incidence and severity of common infections such as colds and influenza, as well as improved recovery from illness. Beyond acute immunity, these fruits support overall health by modulating gut microbiota and protecting cells from free radical damage. Incorporating citrus into daily diets, whether fresh, juiced, or as part of functional foods, offers a natural, accessible and cost-effective strategy for strengthening immune defence and promoting general well-being.

Keywords: *Citrus fruits; vitamin C; flavonoids; antioxidant; immune health*

Epidemiology And Management Of Eumusae Leaf Spot In Banana**Deepak S Kore, Kishorkumar G K and Abhishek***University Of Horticultural Sciences, Bagalkot, Karnataka, India.***ABSTRACT**

Eumusae leaf spot, caused by *Mycosphaerella eumusae* (anamorph: *Pseudocercospora eumusae*), is an emerging foliar disease of bananas and plantains that poses a significant threat to global banana production. First reported in Asia, the disease has since spread to various banana-growing regions, causing severe yield losses due to premature leaf senescence and reduced fruit quality. Symptoms typically begin as small, reddish-brown spots that expand into elliptical lesions with grey to brown centres, ultimately leading to extensive leaf necrosis. The pathogen thrives in warm, humid conditions, with disease severity influenced by prolonged leaf wetness and high rainfall. Unlike other leaf spot diseases such as Black Sigatoka, Eumusae leaf spot affects both dessert and cooking banana cultivars, including traditionally resistant varieties. Effective management relies on integrated strategies, including the use of resistant cultivars, cultural practices that improve air circulation, timely fungicide application and rigorous phytosanitary measures to limit pathogen spread. Understanding the pathogen's epidemiology, host-pathogen interactions and climatic requirements is essential for developing sustainable control measures and safeguarding banana productivity.

Keywords: *Mycosphaerella eumusae; banana; foliar disease; epidemiology; integrated management*

Indigenous Traditional Knowledge (Itk) In Turmeric**Kishorkumar G K, Abhishek and Deepak S Kore***University of Horticultural Sciences, Bagalkot, Karnataka, India.***ABSTRACT**

Indigenous Traditional Knowledge (ITK) has played a pivotal role in the cultivation, processing and utilization of turmeric (*Curcuma longa* L.) for centuries. Rooted in local cultural practices, ITK encompasses a range of eco-friendly and sustainable techniques, including organic manuring, crop rotation, botanical pest control and traditional curing methods that enhance the quality and shelf life of turmeric rhizomes. Farmers' experiential knowledge has been instrumental in selecting locally adapted varieties with desirable traits, such as high curcumin content, disease resistance, and yield stability, under diverse agro-climatic conditions. Traditional post-harvest practices, including boiling, drying and polishing, not only preserve bioactive compounds but also maintain the characteristic colour and aroma valued in culinary and medicinal applications. Integrating ITK with modern scientific approaches presents opportunities to enhance productivity, promote environmental sustainability, and conserve cultural heritage. Documenting and validating these practices is crucial for knowledge transfer, farmer empowerment and the development of climate-resilient turmeric production systems.

Keywords: *Curcuma longa; Indigenous Traditional Knowledge; sustainable agriculture; post-harvest processing; curcumin*

Black Thrips Infestation In Chilli: An Environmental And Agronomic Perspective**Kishorkumar G K, Abhishek and Deepak S Kore***University of Horticultural Sciences, Bagalkot, Karnataka, India.***ABSTRACT**

Chilli (*Capsicum annuum* L.) is a commercially important crop globally, but its production is increasingly threatened by black thrips (*Thrips parvispinus*), a pervasive pest causing significant yield and quality losses, particularly in tropical and subtropical regions. This review synthesizes current knowledge on the biology, ecology and damage potential of black thrips, with a particular focus on the influence of environmental factors and agronomic impacts. The pest feeds on young leaves, flower buds and fruits, leading to leaf curling, stunted growth and significant reductions in both yield and marketable quality. Environmental parameters such as temperature, relative humidity and rainfall play a pivotal role in determining the population dynamics and infestation severity of black thrips. Warmer temperatures and drier conditions have been found to favor rapid population buildup, while extreme humidity and heavy rainfall tend to suppress their activity. The review also explores the complex interactions between environmental stressors, pest outbreaks and chilli plant physiology. Infestation has been associated with decreased chlorophyll content, impaired photosynthetic efficiency and increased vulnerability to secondary infections. Yield losses due to black thrips infestation have been reported to range from 20% to over 60%, depending on agro-climatic conditions and crop stage. Integrated pest management (IPM) strategies, including cultural practices, biological control and selective chemical applications, must be adapted to local environmental contexts for effective control. The review concludes by emphasizing the need for climate-responsive pest forecasting models and region-specific management strategies to mitigate the growing threat of black thrips in chilli cultivation.

Keywords: *Pest outbreak; integrated pest management; black thrips; crop protection*

Cultural And Historical Perspective Of Moringa And Its Health Benefits**Abhishek, Deepak S Kore, Kishorkumar G K and Satish D***University Of Horticultural Sciences, Bagalkot, Karnataka, India.***ABSTRACT**

Moringa (*Moringa oleifera* Lam.), often referred to as the “miracle tree” or “drumstick tree,” has a long-standing cultural and historical significance in traditional medicine and nutrition across Asia, Africa and parts of South America. For centuries, communities have valued Moringa as both a dietary staple and a therapeutic plant, integrating its leaves, pods, seeds and flowers into daily food and medicinal preparations. In Ayurvedic traditions, Moringa has been prescribed for over 300 health conditions, while African folk medicine has used it to combat malnutrition and support maternal health. Historically, its resilience in arid climates made it a critical food security resource, especially during periods of drought and scarcity. Rich in vitamins, minerals, essential amino acids, antioxidants and bioactive compounds, Moringa has been recognized for boosting immunity, reducing inflammation, managing blood sugar levels and improving cardiovascular health. The continued reverence for Moringa in cultural practices underscores its role as both a heritage crop and a modern superfood, bridging ancestral wisdom with contemporary health science.

Keywords: *Moringa oleifera; traditional medicine; cultural heritage; nutrition; immunity*

Entrepreneurship Education: Fostering Innovation, Skills And Economic Growth**Abhishek, Deepak S Kore and Kishorkumar G K***University Of Horticultural Sciences, Bagalkot, Karnataka, India.***ABSTRACT**

Entrepreneurship education has emerged as a critical driver for developing innovative mindsets, practical skills and entrepreneurial competencies among students, professionals and community members. By integrating theoretical knowledge with experiential learning approaches such as business simulations, case studies, mentorship and project based activities, it prepares individuals to identify opportunities, manage risks and create sustainable ventures. Beyond business creation, entrepreneurship education nurtures problem-solving abilities, leadership qualities and adaptability in dynamic market environments. In both developed and developing economies, such education plays a pivotal role in job creation, economic diversification and social empowerment. Incorporating interdisciplinary content, digital tools and real-world industry linkages enhances its relevance and impact. Challenges such as limited resources, outdated curricula and inadequate industry-academia collaboration must be addressed to maximize outcomes. Strengthening entrepreneurship education at all academic levels and through community outreach will not only stimulate innovation and competitiveness but also contribute to long-term socio-economic development.

Keywords: *Entrepreneurship education; innovation; skills development; economic growth; experiential learning*

Effect of soil application of micronutrient zinc on chemical and physical properties of soil in wheat (*Triticum aestivum* L.) field**Suman Yadav***Department of Agronomy, RARI, Durgapura, Jaipur, Rajasthan, India.***ABSTRACT**

Zinc is required for wheat vigorous growth and as Zn is also responsible for activating some enzymatic. To highlight the effects of zinc to enhanced wheat production an experiment was carried out on wheat (*Triticum aestivum*) during rabi season of 2019-20 at the Agriculture Research Farm, Career Point University Kota.. The experiment was laid out in RBD design with Four zinc levels (0, 5, 10 and 15 kg ha) were applied to plots. One of the aim of this study was to determine the effects of different rate of Zinc on the soil physical and chemical properties in wheat field. In order to ascertain the physico-chemical characteristics of the soil, the soil samples were collected from different spots of the experimental field randomly from 0-15 cm soil depths and representative composite sample were subjected to physical and chemical analysis separately. Application of zinc didn't give any significant effect on soil's physical properties. Soil bulk density, WHC and EC whereas dealing with chemical properties zinc had no significant effect on organic carbon content of soil and potassium but the application of zinc significantly increased the available nitrogen (423kg/h) in soil and the application of zinc significant decreased the available phosphorus (17.27kg/ha) in soil with increasing level of zinc.

Keywords: *Triticum aestivum* L; zinc soil application; soil physico-chemical properties

Analysis of Genetic Variability in Agro-Morphological and Grain Quality Traits of Basmati Rice Genotypes from the Himalayan Foothills**Shardool Sharma, Krishna, Piyush Dogra***Department of genetics and plant breeding, CSK HPKV, Palampur, HP, India.***ABSTRACT**

The study was conducted to examine the genetic diversity and trait associations among 25 basmati rice genotypes in the Himalayan foothills, focusing on agro-morphological and grain quality traits relevant for yield improvement and climate resilience. Using a randomized block design, significant variation was observed in major yield contributors such as tillers per plant, spikelets and grains per panicle, all showing high heritability and genetic advance. These traits are ideal for targeted selection under variable climatic conditions. Correlation and path coefficient analyses confirmed positive relationships between yield and both tiller number and grains per panicle, making these crucial selection indices. Disease screening identified lines exhibiting resistance to prevalent stresses like leaf blast and false smut, while aromatic genotypes were also identified, which is vital for consumer preference and marketability. The identified trait combinations underline the potential for selecting high-yielding, quality and disease-resistant lines suitable for eco-climatic adaptation in mountain agriculture, offering strategies to mitigate climate related risks. The study's approach and findings can guide rice improvement programs aiming for resilience and productivity amid changing climate scenarios, relevant for Himalayan and various similar agro-ecologies.

Keywords: *Basmati; agro-morphological; correlation; path coefficient; mountain agriculture; resilience; agro-ecologies*

The Impact of Climate Change on Horticulture**Salman Khan, Virendra Singh***Department of Horticulture, RCA, MPUAT, Udaipur, Rajasthan, India.***ABSTRACT**

Change is an undeniable and pressing challenge of our era, with far-reaching consequences that extend to horticulture, a critical component of global food production and economic sustainability. Global temperatures are rising, leading to shifting climate patterns and an increased frequency of extreme weather events. These shifts pose significant challenges to horticulture, where specific environmental conditions are susceptible to disruption by climate change. Rising temperatures, for instance, affect plant development, flowering, and fruiting, ultimately impacting crop yields. The effects of climate change are not uniform across regions. Vulnerabilities and adaptive capacities vary depending on geographic location and socio-economic context. Regions with fragile ecosystems and limited resources are at heightened risk, while regions with established infrastructure and adaptive capabilities have better means to mitigate and adapt. Climate change is reshaping horticulture, presenting challenges, and opportunities. By adopting adaptive strategies and continuing research endeavors, horticulture can endure and thrive, contributing to global food security and sustainable agriculture. Fruit farming is crucial to global agriculture and food security. Fruit tree phenology is one of the most visible effects of climate change on horticultural crops. Flowering, fruit setting, maturity, and harvesting depend on temperature. This review paper presents a comprehensive exploration of the impact of climate change on horticulture, offering a global perspective while emphasizing adaptation strategies to address these challenges. The effects of climate change on post-harvest processes and the adoption of novel technologies are also explored within the context of post-harvest. Additionally, the integration of horticulture and landscape architecture is emphasized as a crucial strategy in adapting landscaping practices to the variability brought about by climate change.

Keywords: *Climate change; Horticulture; Adaptation Strategies; Plant development; food security.*

The Impact of Climate Change on Horticulture**Ravindra Kumar Meena***Department of Entomology, COA Jabalpur, JNKVV, Jabalpur, Madhya Pradesh, India.***ABSTRACT**

Black gram *Vigna mungo* L, also known as urdbean, mash, or mashkalai, is a member of the Fabaceae family and Papilionoideae subfamily. It is the fourth-most important short-duration pulse crop in India, contributing about 10% of national pulse production, and is native to the Indian subcontinent. Nutritionally, it contains high protein (20.8–30.5%), carbohydrates (56.5–63.7%), minerals (3.2%), iron (9.1 mg/100 g), fiber (0.9%), fat (1.4%), phosphorus (385 mg/100 g), calcium (154 mg/100 g), and has a calorific value of 347 kcal/100 g. Field observations revealed that whitefly and Bihar hairy caterpillar appeared earliest, at 6 and 13 days after sowing (DAS), and persisted until 89 DAS. The white-spotted leaf beetle was active from 13–37 DAS; tobacco caterpillar and jassid from 16–71 and 16–69 DAS; blister beetle and Chinese grasshopper from 41–71 and 47–89 DAS. Green stink bug and pod bug were recorded from 54–82 DAS, while bean bug appeared from 61–85 DAS. Predators included dragonflies (19–89 DAS) and ladybird beetles (41–85 DAS). Peak pest populations occurred between the 35th–38th Standard Meteorological Weeks. Fipronil 40% + Imidacloprid 40% WG and Spinosad 45% SC were most effective against whitefly and Bihar hairy caterpillar, while Flubendiamide + Thiacloprid, Fipronil + Imidacloprid, and Fipronil 5% SC were most economical.

Keywords: *Black gram; Vigna mungo; pulse crop; pest incidence; whitefly; Bihar hairy caterpillar; predators; insecticide efficacy; Fipronil; Spinosad*

Integrated Nutrient, Weed, Pest, and Disease Management for Sustainable Agriculture India
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ABSTRACT

Integrated management practices are critical for achieving sustainable, cost-effective, and environmentally friendly crop production. Integrated Nutrient Management (INM) involves the judicious and balanced use of chemical fertilizers, organic manures, and biofertilizers to maintain soil fertility and ensure higher crop yields without degrading the environment. Integrated Weed Management (IWM) combines preventive and curative measures including mechanical weeding, crop rotation, mulching, intercropping, and the selective use of herbicides to reduce weed competition and improve crop growth. Integrated Pest Management (IPM) focuses on maintaining pest populations below economic threshold levels through biological control agents, pest-resistant varieties, cultural practices, and minimal chemical usage to avoid resistance and environmental contamination. Similarly, Integrated Disease Management (IDM) adopts strategies like crop rotation, use of disease-free seeds, resistant varieties, timely sowing, and need-based fungicide applications to control diseases effectively. These integrated approaches, when applied together, enhance input efficiency, minimize production losses, improve soil health, reduce environmental risks, and ensure the economic viability of farming systems. They are especially important under rainfed or low-input conditions where external inputs are limited. Hence, integration of nutrient, weed, pest, and disease management is a vital component of sustainable agricultural development, ensuring long-term productivity, food security, and resilience to climate variability.

Keywords: *Integrated nutrient management; weed control; pest management; disease control; sustainable agriculture; soil health; biofertilizers; crop protection*

Integrating Biofertilizers and Biostimulants for Improved Yield, Quality, and Soil Health in Fodder Cowpea: A Sustainable Approach to Reducing Chemical Fertilizer Use

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ABSTRACT

The overuse of chemical fertilizers, while beneficial for boosting crop productivity, leads to challenges such as soil degradation and a significant subsidy burden on the government, with approximately ₹1.64 lakh crore allocated to fertilizers in the 2024-2025 budget (Department of Fertilizers, 2024). This study explores the use of biological inputs, such as biofertilizers (Plant Growth-Promoting Rhizobacteria and Vesicular Arbuscular Mycorrhizae) and biostimulants (seaweed extracts and amino acids) to reduce chemical dependency in crop cultivation. While complete replacement of chemical fertilizers is impractical due to their immediate nutrient availability and high yield support, partially substituting them with biological inputs strikes a balance between sustainability and practicality. Fodder cowpea (*Vigna unguiculata*), a hardy legume known for its high-quality fodder yield and crude protein content of 16–20% (Dutta et al., 2019), can also fix up to 61–86 kg of nitrogen per hectare in a single growing season, significantly improving soil fertility (Adjei-Nsiah et al., 2008). It was cultivated during the 2023-24 Kharif season at the Agronomy Research Block, NDRI, Karnal, using treatments combining reduced fertilizer doses with biological inputs. These treatments improved soil fertility by enhancing nutrient availability (N, P, K), microbial activity, and enzymatic processes, ensuring better long-term productivity. In addition to improving soil health, the study showed enhanced fodder yield and quality,

with increased crude protein and antioxidants, essential for livestock nutrition. Economic analysis revealed that integrating biological inputs reduced input costs and increased returns, making it both sustainable and cost-effective. This approach not only addresses the issue of high fertilizer subsidies but also contributes to broader economic sustainability by promoting more efficient, eco-friendly farming practices. This study presents a practical framework for reducing chemical inputs, enhancing soil health, lowering subsidies, and supporting eco-friendly agriculture.

Keywords: *Chemical fertilizers; Biostimulants; Soil fertility; Fodder cowpea; Sustainable agriculture; Economic sustainability*

Climate Responsive Water and Nutrient Management Strategies for Fodder Oats in the Indo-Gangetic Plains

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ABSTRACT

The study was conducted to study the influence of prolonged climatic shifts and weather extremes on fodder oats productivity in the Indo-Gangetic Plains across a 30-year timeframe (1995–2024). Using 13 standardized indices generated through Climpack software, temporal patterns were assessed with the help of the Mann-Kendall test, Sen's slope, and Innovative Trend Analysis. This study assessed long-term changes in climatic and extreme weather indices and their implications for fodder oats cultivation in the Indo-Gangetic Plains over a 30-year period (1995–2024). Using 13 climate and extreme weather indices calculated through Climpack software, temporal trends were evaluated using the Mann-Kendall test, Sen's slope estimator, and Innovative Trend Analysis (ITA). The analysis revealed increasing variability in precipitation patterns, with trends in Standardized Precipitation Index (SPI12) and Standardized Precipitation Evapotranspiration Index (SPEI12) indicating a growing frequency of drought episodes. To address these challenges, the study recommends efficient water management through pressurized irrigation systems, which can enhance water use efficiency under erratic rainfall conditions. Furthermore, balanced nutrient management—especially potassium—was suggested to improve crop resilience to thermal stress. The use of slow-release fertilizers was also advocated to minimize nutrient leaching during high-intensity rainfall events, thereby improving nutrient availability during critical growth stages. These adaptive strategies provide actionable pathways to improve climate resilience in fodder oats production, supporting sustainable intensification under increasingly variable agro-climatic conditions.

Keywords: *Climate variability; Indo-Gangetic Plains; Standardized Precipitation Index; Standardized Precipitation Evapotranspiration Index*

Advancing Agricultural Profitability through Post-Harvest Technologies and Mechanization **Abstract**

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ABSTRACT

Post-harvest technologies and mechanization play a pivotal role in reducing losses, enhancing product quality, and improving the profitability of agricultural enterprises. In many developing regions, post-

harvest losses in horticultural and field crops range from 20–40%, primarily due to inadequate handling, storage, and processing facilities. Adoption of advanced mechanization—such as mechanical harvesters, graders, dryers, cold storage systems, and packaging machinery—ensures timely operations, minimizes qualitative and quantitative losses, and extends marketability. Integration of value-addition technologies like controlled atmosphere storage, modified atmosphere packaging, and minimal processing not only maintains freshness but also enables farmers to access premium markets. Mechanization reduces labor dependency, increases operational efficiency, and enables large-scale processing, thereby enhancing the supply chain's competitiveness. Furthermore, linking these technologies with digital tools such as IoT-based monitoring and automated control systems optimizes energy use and ensures consistent product standards. Overall, investment in post-harvest mechanization not only safeguards farm produce but also transforms agriculture into a more sustainable, profitable, and market-oriented sector.

Keywords: *Post-harvest technology; mechanization; value addition; profitability; loss reduction; marketability*

White Grub: A Farmer's Hidden Pest

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ABSTRACT

White grubs, the larval stage of scarab beetles (family: Scarabaeidae), are among the most destructive soil-dwelling pests affecting agricultural crops. Commonly referred to as a "hidden pest" by farmers, these larvae live underground, feeding on plant roots and causing severe damage that often goes unnoticed until crop symptoms appear. Their cryptic lifestyle makes early detection challenging, as the initial signs—yellowing, wilting, and stunted growth—are easily mistaken for nutrient deficiencies or drought stress.

White grubs have a broad host range, attacking cereals, vegetables, sugarcane, groundnut, and pasture grasses. They are most prevalent during the rainy season when beetles lay eggs in moist soil. Upon hatching, the larvae feed voraciously on root systems, disrupting water and nutrient uptake, which can lead to plant death. Economic losses can be substantial, particularly in sandy soils where root damage occurs more rapidly.

Management of white grubs requires an integrated approach. Cultural practices such as deep ploughing, crop rotation, and timely irrigation can help reduce grub populations. Biological control, using entomopathogenic fungi (e.g., *Metarhizium anisopliae*) or nematodes, offers eco-friendly alternatives to chemical insecticides. Light traps and pheromone traps are useful for monitoring and reducing adult beetle populations before egg-laying. Chemical control, though effective, should be used judiciously to avoid environmental harm and resistance development.

Understanding the life cycle and behaviour of white grubs is critical for timely intervention. By adopting integrated pest management strategies, farmers can minimize crop losses, safeguard soil health, and reduce dependence on chemical pesticides, ensuring sustainable agricultural production.

Keywords: *White grubs; Scarab beetles; Hidden pest; Entomopathogenic fungi*

Impact of different Irrigation sources and fertilizer levels on the yield and macronutrient content of berseem**Anjali Mehta¹, Samiksha Pandey¹, Krishna²**¹*Agronomy Section, ICAR-National Dairy Research Institute, Karnal, India.*²*Department of Agronomy, CSK HPKV, Palampur, HP, India.***ABSTRACT**

Climate change is intensifying challenges in agriculture, particularly due to rising water scarcity and resource degradation. Efficient irrigation and nutrient management are essential for sustaining crop productivity and reducing environmental impacts. Using alternative water sources like treated wastewater can help meet irrigation needs while also providing essential nutrients. Hence, a field experiment entitled “Impact of different Irrigation sources and Fertilizer levels on the yield and macronutrient content of berseem” was conducted during *Rabi* season, 2023 at Agronomy Research Farm, ICAR-National Dairy Research Institute, Karnal (Haryana). The experiment followed a split plot design (SPD), in which the main plot treatments were comprised of three irrigation sources; tube well irrigation (TW), mixed water irrigation (MW), and treated wastewater irrigation (TWW), while four levels of fertilizers; control (F1), 50% RDF (F2), 75% RDF (F3), and 100% RDF (F4), were taken under sub-plot treatments, with three replications. The impact of different sources of irrigation and levels of fertilizers were observed on the fresh fodder and dry fodder yield and macronutrient (N, P and K%) content of berseem across four cuts. The application of TWW improved green fodder yield by 9.66% and 9.91%, and dry fodder yield by 19.78% and 19.25% at the first and final cuts, respectively, compared to the control. These results were statistically at par with those obtained from MW irrigation. A significant interaction between irrigation sources and fertilizer levels was also observed for the yields. Similarly, the N, P and K content of the crop at final harvest was increased by 10.70, 12.83 and 11.89%, respectively under TWW application. Application of 100% RDF significantly increased green fodder yield by 57.18%, dry fodder yield by 69.46%, and N, P, and K contents by 16.83%, 21.25%, and 27.88%, respectively, at final harvest. These outcomes were statistically similar to those under 75% RDF. Thus, it can be concluded that applying treated wastewater with 75% RDF is a viable option to improve the yield and nutrient content of berseem while optimizing the water use and conserving the resources.

Keywords: *Treated wastewater; Irrigation sources; Berseem; Resource conservation; Nutrient use efficiency; Sustainable agriculture*

From Structure to Success: Functional Drivers of Farmer Producer Organization Performance in Haryana**Tribhuwan Singh Rajpurohit^{1*}, Rohtash Kumar², Ravindra Singh Choudhary³**¹*RNB Global University, Bikaner, Rajasthan, India.*²*ICAR-CSSRI, Karnal, Haryana, India.*³*ICAR-IIMR, Ludhiana, Punjab, India.***ABSTRACT**

The functional architecture of Farmer Producer Organizations (FPOs) plays a decisive role in determining their operational performance, resilience, and long-term sustainability. This study evaluates the status of four critical functional domains—governance and management, group dynamics, members’ representation, and audit—and their implications for FPO effectiveness in Haryana. A total of 240 members from eight FPOs, equally supported by the Small Farmers’ Agri-Business Consortium (SFAC) and the National Bank for Agriculture and Rural Development (NABARD), were surveyed using a structured interview schedule. Weighted Mean Scores (WMS) were computed for individual functional parameters, and categorical classifications (Good, Average, Poor) were applied to assess their relative strengths and weaknesses.

The governance and management domain demonstrated its strongest performance in *information management* (WMS: 2.18) and *business promotion* (WMS: 2.17), both of which facilitate efficient decision-making and enhanced market penetration. However, *capacity building activities* (WMS: 1.80) and *mobilization of membership* (WMS: 1.88) ranked lowest, with 21.25% of respondents rating governance performance as Poor—signifying potential constraints in adaptive capacity and organizational growth. Group dynamics were led by *group leadership* (WMS: 2.33), fostering cohesion and strategic alignment, yet gaps in *group decision-making* (WMS: 2.02) and *interpersonal trust* (WMS: 2.11) limit participatory synergy. Members' representation exhibited a strong commitment to democratic norms through *free and fair elections* (WMS: 2.65), though *regularity in attendance for meetings* (WMS: 1.85) and *social justice in representation* (WMS: 1.89) remain underdeveloped, with 22.50% rating representation as Poor. The audit domain was anchored by robust *financial auditing* (WMS: 2.28) and *transparency of accounts* (WMS: 2.10), enhancing institutional credibility, but *social audit* (WMS: 1.87) underperformed, indicating limited accountability in social outcomes.

The combined evidence from both WMS rankings and categorical distribution underscores that high-performing FPOs are characterized by strong administrative systems, democratic governance, and financial accountability, whereas deficiencies in capacity building, social inclusivity, and participatory engagement constrain holistic effectiveness. Strengthening these weaker functional pillars could yield significant future benefits, including enhanced adaptive capacity, diversified income opportunities, deeper member trust, and improved integration into agri-value chains. These findings suggest that targeted capacity-building interventions, coupled with robust governance and comprehensive auditing mechanisms, can transform FPOs into sustainable, market-competitive, and socially responsive farmer institutions.

Keywords: *Farmer Producer Organizations; governance; group dynamics; representation; audit; sustainability; organizational effectiveness*

Biology impact and management of the stem borer (*Chilo partellus*)

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ABSTRACT

Chilo partellus (spotted stem borer) is a destructive lepidopteran pest of maize (*Zea mays*) and sorghum (*Sorghum bicolor*), causing yield losses ranging from 26% to over 80% in heavily infested fields. Native to Africa and South Asia, its spread to new regions has raised concerns about global biosecurity. The insect also attacks pearl millet and certain wild grasses.

The pest's life cycle spans 35–51 days, influenced by temperature. Eggs, laid in clusters on leaves, hatch in 4–5 days. Creamy-white larvae with distinctive brown dorsal spots pass through six instars over 3–4 weeks, boring into stems and feeding on growing points. Damage symptoms include “shot-holes” in young leaves, stem tunnelling, “dead heart” in younger plants, and “white head” in older plants. Pupae, reddish-brown to pale yellow-brown, emerge as nocturnal moths with straw-coloured forewings and white hindwings.

Control of *C. partellus* requires an Integrated Pest Management (IPM) approach. Cultural methods include stubble destruction, early planting, and push–pull systems using repellent and trap crops. Chemical options, such as Spinetoram or Chlorantraniliprole, target early larval stages, while biocontrol agents like *Cotesia flavipes* parasitize larvae. Neem-based biopesticides and resistant crop varieties offer sustainable alternatives.

Given its severe economic impact, effective and durable management depends on understanding the pest's biology and behavior. Continued research into host plant resistance, eco-friendly pesticides, and improved cultural strategies is vital to safeguarding maize and sorghum yields in affected regions.

Keywords: *Chilo partellus; Spotted stem borer; Maize pest; Life cycle; Crop damage*

Impact of inorganic pesticides on Environment condition**Khushboo Dubey¹ and Gyan Prakash Singh²**¹*Department of Plant Pathology, IANS, DDUGU, Gorakhpur, U.P., India.*²*Department of Agricultural Economics, IANS, DDUGU, Gorakhpur, U.P., India.***ABSTRACT**

Pesticides are chemicals that kill pests or disrupt pest populations. A pest is an organism that causes some type of damage to something we value. Furthermore, pesticides can be grouped in a number of different ways based on their active ingredients and how they work such as synthetic pesticides, organic pesticides, inorganic pesticides and bio rational pesticides.

Pesticides in this group, for example borates, silicates and sulfur, are minerals that are mined from the earth and ground into a fine powder. Some work as poisons and some work by physically interfering with the pest. Older "inorganics" included such highly toxic compounds as arsenic, copper, lead and tin salts. Current inorganic pesticides are relatively low in toxicity and have low environmental impact. Borate insecticides, such as Bora Care and Timbor have many uses in structural pest management and are very safe compared to older conventional pesticides.

Biofortification: A Sustainable Agricultural Strategy for Reducing Malnutrition**Khushboo Dubey¹ and Gyan Prakash Singh²**¹*Department of Plant Pathology, IANS, DDUGU, Gorakhpur, India.*²*Department of Agricultural Economics, IANS, DDUGU, Gorakhpur, India.***ABSTRACT**

Micronutrients are not only important for better crop productivity, but also essential for sustaining human and animal health. There is a widespread deficiency of zinc in the Indian soils. Micronutrient malnutrition is known to affect more than half of the world's population and considered to be among the most serious global challenges to mankind. Malnutrition is of great public health significance in several parts of the world, especially the developing and underdeveloped countries. Deficiency of minerals such as Fe and Zn can cause various severe health issues. Low Zn levels lead to stunted growth and immune dysfunction (Sauer et al. 2016). Modern plant breeding has been historically oriented towards achieving high agronomic yields rather than nutritional quality, and other efforts related to alleviating the problem have been primarily through industrial fortification or pharmaceutical supplementation. Micronutrient deficiencies in humans can be mitigated through the process biofortification. Biofortification is a promising and sustainable agriculture-based strategy to minimize Zn and Fe deficiency in dietary food substances (Vasconcelos et al. 2017). Foliar fertilization with micronutrients often stimulates more nutrient uptake and efficient allocation in the edible plant parts than soil fertilization, especially with cereals (Lawson et al. 2015). The combination of soil and foliar application is often the most effective method in rice (Phattarakul et al. 2012). Agronomic bio-fortification could be a rapid solution to enrich the food crops and reduce micronutrient malnutrition in humans. The time of achieving and broader adoption by all sorts of farming community and feasibility of agronomic biofortification gains momentum.

Soil Carbon Sequestration: A Sustainable Pathway to Climate Change Mitigation**Shivani Agarwal, S. K. Kharia and Deshraj Meena***Department of Soil Science and Agricultural Chemistry, College of Agriculture, SKRAU, Bikaner (Rajasthan), India.***ABSTRACT**

Rising atmospheric carbon dioxide (CO₂) concentrations remain the principal driver of global climate change, necessitating scalable and sustainable mitigation strategies. Carbon sequestration, encompassing both natural and engineered processes, offers a viable pathway to reduce net greenhouse gas emissions and enhance ecosystem resilience. Soil carbon sequestration has emerged as a promising nature-based solution to mitigate climate change while simultaneously enhancing soil health and agricultural productivity. Globally, soils contain nearly three times more carbon than the atmosphere, underscoring their potential as significant carbon sinks. This review study summarizes current scientific evidence on soil carbon sequestration, highlighting the mechanisms, benefits, and challenges associated with its adoption. Carbon storage in soils occurs through the stabilization of organic matter, root biomass inputs, and improved aggregate formation, processes that can be enhanced by practices such as conservation tillage, cover cropping, agroforestry, residue retention, and organic amendments. Research indicates that widespread adoption of these practices can sequester 0.4–1.2 Mg C ha⁻¹ yr⁻¹, contributing substantially to offsetting anthropogenic greenhouse gas emissions. Beyond climate benefits, soil carbon sequestration improves nutrient cycling, water retention, and resilience against land degradation. However, long-term stability of sequestered carbon is influenced by soil type, climate, and land management, requiring site-specific strategies. Policy incentives, carbon credit mechanisms, and farmer awareness are essential to scale up implementation. Overall, soil carbon sequestration represents a cost-effective and sustainable approach that links climate change mitigation with food security and ecosystem resilience.

On Farm Trial on Rice Variety JR 81 in Katni District of Madhya Pradesh: A Impact Study**Arpita Shrivastava¹, R. P. Bain², Sanjay Vaishampayan³ and Smita Singh⁴**¹*Scientist, Krishi Vigyan Kendra, Katni, India.*^{2,3}*Krishi Vigyan Kendra, Katni, India.*⁴*Krishi Vigyan Kendra, Rewa, India.***ABSTRACT**

Rice is major staple food for half of the world's half population and grown under the wide range of climatic condition but non non-availability of high yielding medium duration rice variety is the main concern among the farmers. KVK Katni made an attempt with an objective to substitute existing variety with high yielding medium duration rice variety JR 81. The OFT on improved variety JR 81 was carried out during the three consecutive years from 2021-2023 in adopted villages of Katni district. The improved variety JR 81 exhibited mean grain yield 52.67 q/ha which 18.13% higher than the farmer practices. This is result of combined effect of knowledge and adopting of improved variety JR 81 along with the scientific package of practices. This OFT might give positive impact on farming community in the district. The technology gap of the demonstration plot were 7.33 q/ha and Extension gap of 9.55 q/ha. The technology index varied from 12.00% to 12.58% with a mean value of 12.22%. . This shows the efficacy of improved variety JR 81 coupled with scientific package of practices. This will accelerate with the adoption of demonstrated technology to increase the yield of rice. This variety found to be suitable since it fits well to the existing farming situation and also it had been appreciated by the farmers. In the coming years, rice grower contributes much to the district economy.

Keywords: *OFTs; Improved variety; Rice*

**Assessment of improved Lentil variety RVL 31 under irrigated condition in Rewa District of M.P.
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ABSTRACT

Krishi Vigyan Kendra, Rewa conducted 05 On farm trials on Lentil varieties RVL-31 during 2024–25 at farmer's field. The critical inputs were identified in existing production technology through meetings and discussions with farmers & on the basis of soil sampling. The main factors contributing to the low production of pulses in district Rewa were delayed planting and the use of increased seed rates, which resulted in dense and uneven plant populations; uncontrolled weeds; ignorance of fertilizers; and a lack of plant protection measures. For the purpose of evaluating the effects of on-farm trials on lentil crops and the viability of shown technologies at the grassroots level, additional factors such as technological impact, economic impact, and extension gap were examined in the same order. In the same sequence the other parameters like technological impact, economical impact and extension gap were analyzed for Impact assessment of On farm trials on lentil crop and feasibility of technologies at grass root levels. The results of 2024-25 study revealed that the yield under on farm trials of variety RVL 31 was 17.25 q/ha as compared to 8.75 q /ha in traditional farmer practices plots.

Keywords: *Impact; Lentil crops; On farm trials*

Climate Change and Plant Stress: Understanding Molecular Mechanisms for Sustainable Agriculture

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ABSTRACT

Climate change is one of the most pressing issues of our time, with far-reaching consequences for global food security, ecosystems and human societies. Rising temperatures, altered precipitation patterns and increased frequency of extreme weather events are all taking a toll on plant growth and productivity. Understanding how plants respond to these stresses at the molecular level is crucial for developing sustainable agricultural practices that can mitigate the impacts of climate change. This presentation will discuss the molecular mechanisms underlying plant stress responses to climate change, including the role of signaling pathways, transcription factors and stress-related genes. We will explore how plants perceive and respond to environmental stresses, such as drought, heat and salinity, and how these responses can be harnessed to improve crop resilience. Recent advances in molecular biology and biotechnology have opened up new avenues for improving plant stress tolerance. We will discuss the potential of genetic engineering, genome editing and marker-assisted breeding for developing climate-resilient crops. Additionally, we will highlight the importance of understanding the complex interactions between plants, microbes and the environment in developing sustainable agricultural practices. By understanding the molecular mechanisms underlying plant stress responses, we can develop innovative solutions to improve crop productivity and resilience in the face of climate change. This knowledge can be used to develop more efficient irrigation systems, improve soil health, and promote sustainable agricultural practices that support ecosystem services and biodiversity.

Impact of Climate Change on Farming and Agricultural Productivity**Hemraj Kumawat***Department of Extension Education, Rajasthan College of Agriculture (MPUAT), Udaipur, Rajasthan, India.***ABSTRACT**

Climate change is among the most crucial concerns of the world. It is a serious threat to the global agriculture and its productivity. A rise of 2.5-4.5 ° c is expected in the global temperature until the end of 21st century. Climate change is a global threat to the food and nutritional security of the world. Climate change presents real threats to agricultural production, forest resources and rural economies. These threats have significant implications not just for farmers, ranchers and forest landowners, but for all people. Land managers across the country are already feeling the pressures of a changing climate and its effects on weather. The effects of climate change on agriculture can result in lower crop yields and nutritional quality due to drought, heat waves and flooding as well as increases in pests and plant diseases. Climate change impacts on agriculture are multifaceted and encompass diverse aspects such as crop yields, water availability, pest and disease dynamics and overall agricultural productivity. These impacts vary across regions, but no country is immune to the consequences of a changing climate. Understanding the intricate relationship between climate change and agriculture is essential for developing effective strategies to mitigate and adapt to its effects. Climate change also affects an ecosystem directly or indirectly. Changes in climate will affect the groundwater recharge, water cycle, soil moisture, livestock and aquatic species. Due to climate change, deterioration in soil fertility, promoting salinity, defiance of many pesticides, herbicides and deterioration of irrigation water quality should be found. Agriculture is strongly influenced by weather and climate. While farmers are often flexible in dealing with weather and year-to-year variability, there is nevertheless a high degree of adaptation to the local climate in the form of established infrastructure, local farming practice and individual experience. Climate change can therefore be expected to impact on agriculture, potentially threatening established aspects of farming systems but also providing opportunities for improvements. Climate change has significant and far reaching impacts on world agriculture, reduced crop yields and income and lead to poverty, increased pest and disease pressure on food production and poses risks to global food security. 2030 Agenda for Sustainable Development adopted by all United Nations Member States in 2015 deals with 17 Sustainable Development Goals. Climate change has profound and varied impacts on crop production, which can significantly affect global food security.

Keywords: *Climate change; impacts; infrastructure; production*

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Adaptation and Mitigation Strategies in *Capsicum annuum*: Enhancing Resilience to Climatic and Environmental Stress**Kishorkumar G K, Anusha M S and Kushal V Gowda***University of Horticultural Sciences, Bagalkot, Karnataka, India.***ABSTRACT**

Capsicum annuum (chili pepper) is a globally important horticultural crop valued for its nutritional, economic and cultural significance. However, its productivity is increasingly threatened by various climatic and environmental stressors such as drought, heat, salinity and pest pressure factors exacerbated by climate change. This study reviews and synthesizes current adaptation and mitigation strategies aimed at enhancing the resilience of *C. annuum* under these challenging conditions. Adaptation strategies include the development and use of stress-tolerant cultivars through conventional breeding and molecular techniques, such as marker-assisted selection and CRISPR-based genome editing. Agronomic practices like mulching, optimized irrigation (e.g., drip systems), intercropping and the application of biostimulants and biofertilizers have also shown promise in improving stress tolerance. Physiological adaptations, including enhanced root architecture, osmotic regulation and antioxidant enzyme activity are the key traits in stress-resilient genotypes. Mitigation efforts focus on reducing the crop's environmental footprint while maintaining yield. These include integrated pest management (IPM), climate-smart fertilization practices and precision agriculture technologies that optimize resource use efficiency. Furthermore, the adoption of controlled-environment agriculture (e.g., greenhouses, shade nets) is gaining importance in managing extreme weather events. Overall, a multidisciplinary approach combining genetic, physiological and agronomic innovations is essential for safeguarding *Capsicum annuum* production in the face of climate variability. Future research should focus on genotype-environment interactions and scalable technologies to support sustainable chili cultivation across diverse agroecological zones.

Keywords: *Biostimulants; Biofertilizers; CRISPR; Genome editing and Capsicum annuum***Adaptive Responses and Management Strategies for Murda Complex in *Capsicum annuum*****Kishor kumar G K, Anusha M S and Kushal V Gowda***University of Horticultural Sciences, Bagalkot, Karnataka, India.***ABSTRACT**

Murda complex is a severe disease affecting *Capsicum annuum* (chili pepper), particularly under climate-stressed conditions. Characterized by stunted growth, leaf curling, reduced fruit set and premature plant death, the disease is typically associated with a complex interaction of viral pathogens often transmitted by insect vectors such as thrips and whiteflies. The increasing incidence and severity of murda complex in major chili-growing regions have been linked to fluctuating climatic conditions, including rising temperatures, irregular rainfall and extended dry spells, which favour vector proliferation and virus transmission. The current understanding of murda complex etiology and explores adaptive and remedial strategies to manage its impact under climate variability. Adaptive approaches include the development and deployment of resistant or tolerant chili varieties through conventional breeding and molecular-assisted selection. Cultural practices such as timely planting, crop rotation, intercropping with non-host species and the use of reflective mulches have shown efficacy in reducing disease pressure. Remedial strategies focus on vector management using integrated pest management (IPM) techniques, including biological control agents, botanicals, and selective insecticides. Additionally, climate-resilient agronomic practices such as soil health improvement, efficient irrigation and microclimate regulation play a vital role in reducing plant stress and susceptibility. Given the complex nature of the disease and its climate-sensitive dynamics, a multidisciplinary and region-

specific approach is essential. Continued research into pathogen-vector interactions, early detection systems and farmer-level awareness programs will be critical in mitigating the spread and impact of murda complex in *Capsicum annuum* cultivation.

Keywords: *Capsicum annuum*; Crop rotation; Intercropping; Thrips and Whiteflies

Study of the Growth Pattern of Dendrocalamus Hamiltonii in the Soil

Abha Jha

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ABSTRACT

During research, after the hardening of *Dendrocalamus hamiltonii*, a detailed study of growth and biomass production potential was gradually conducted. A randomized complete block design with three replications was used. Nine plantlets were planted per plot, with 2.5 meters spacing between plants and 2.00 meters within rows. During data collection, the parameters of concern were: sprouted culms per clump, culm height, culm diameter at breast height (DBH), average number of nodes, and internode length per culm. At the age of 3 years after planting, one clump of *D. hamiltonii* per plot was uprooted and sorted into different portions (rhizome, culm, branches, and leaves). The fresh weight was measured for biomass production, and samples were dried constantly. The difference between fresh and dried measures the biomass production in three years of development. These assessments were the study of the growth pattern of *D. hamiltonii*.

Keywords: Growth pattern; DBH; Biomass; average number of nodes and internodes

Assessment of Wood Specific Gravity in the Moist Tropical Forests of Buxa Tiger Reserve, West Bengal, India

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ABSTRACT

The sustainable management of forest resources requires accurate knowledge of wood properties, such as specific gravity, which influences timber quality and ecological functions. However, baseline data on wood density for many tree species in the Buxa Tiger Reserve region remain limited. To address this gap, the present study was conducted to assess the specific gravity of 109 tree species in the West Rajabhatkhawa Range of Buxa Tiger Reserve, West Bengal, India, between 2019 and 2022. The study area is broadly classified as a moist tropical forest according to Champion and Seth (1968). Vegetation analysis was conducted using 140 nested quadrats of varying sizes with a sampling intensity of 0.1 % across 18 forest compartments covering 5,631 hectares. The wood samples of the recorded 109 tree species were collected from the main stem at breast height using a Pressler's increment borer. Specific gravity was calculated by the maximum moisture method, with green weight recorded in the field and oven-dry weight measured in the laboratory. The results showed that specific gravity ranged from a low of 0.25 ± 0.033 in *Tetrameles nudiflora* to a high of 0.87 ± 0.012 in *Terminalia chebula*, with medium values observed in *Ficus racemosa* (0.50 ± 0.050) and *Tectona grandis* (0.51 ± 0.017). Among the 109 species recorded, 13 exhibited low specific gravity (0.25–0.40), 76 species had medium specific gravity values (0.41–0.60), and the remaining 20 species showed high specific gravity values (0.61–0.87). These results reveal significant interspecific variability in wood density, emphasizing its critical role in influencing species-specific ecological functions and commercial potential. The generated baseline data

provide a foundation for enhancing the precision of forest inventories, optimizing sustainable timber harvesting practices, and informing targeted conservation and management interventions within the reserve. Moreover, these findings can be utilized in biomass estimation, carbon stock assessments, wood quality evaluation, and ecological modelling, thereby supporting broader efforts in climate change mitigation and sustainable forest management. This study highlights the necessity of incorporating species-specific wood property metrics into forest resource assessments to improve management efficacy and ecological sustainability.

Keywords: *Specific Gravity; Wood Density; Moist Tropical Forest; Buxa Tiger Reserve; Carbon Stock*

Innovative Approaches in Agriculture: Integrating Bio-Nanotechnology, Molecular Diagnostics, and Structural Biology

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ABSTRACT

The integration of bio-nanotechnology, molecular diagnostics, and structural biology is revolutionizing modern agriculture by enabling precise detection, monitoring, and enhancement of crop health and productivity. Bio-nanotechnology introduces nanoscale tools and materials that improve the delivery of agrochemicals, enhance nutrient absorption, and provide innovative biosensors for real-time plant disease detection. Molecular diagnostics, empowered by nanoscale innovations, offers rapid and accurate identification of plant pathogens, genetic traits, and stress markers, facilitating early intervention and improved crop management. Structural biology contributes by elucidating the molecular mechanisms underlying plant-pathogen interactions and stress responses, guiding the development of targeted strategies for crop protection and genetic improvement. Collectively, the convergence of these disciplines is driving sustainable agricultural practices, optimizing yield, and ensuring food security in the face of environmental challenges. This review highlights recent advancements and future perspectives on the role of bio-nanotechnology, molecular diagnostics, and structural biology in transforming agricultural science.

Keywords: *Structural biology; Precision agriculture; Plant disease detection; Nanobiosensors; Crop protection; Nanodelivery systems*

Assessment of groundnut variety for rainfed location in Tikamgarh District

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ABSTRACT

Groundnut (*Arachis hypogaea* L.) is also known as peanut and considered the “King of Oilseeds”, is a primary oilseed crop in India and an important oilseed crop found in tropical and subtropical region of the world. Groundnut a self-pollinated legume is an important crop cultivated in 24 Mha the world over for extraction of edible oil and food purpose. There are about 70 species of groundnut that are grown in more than 100 different countries globally. The present study was conducted during *kharif* season 2021-22 and 2024-25 in Tikamgarh and Jatara blocks of Tikamgarh district, comprising ten numbers of farmers from two adopted villages of Krishi Vigyan Kendra, Tikamgarh, in Bundelkhand Zone of Madhya Pradesh. Farmer’s participatory field trials on Groundnut Var GJG 32 and farmers’ local variety Jumkul were conducted on; on farm trails Observation on growth traits and the important yield and its morphological parameters are *viz*; pod per plant, numbers of pods per plant along with 100 seed weight were taken and economic analysis was done. The final seed yield was recorded at the time of harvest

and the gross return in (Rs 152500 ha⁻¹) was calculated based on govt. maximum support prices. The results from the demonstration conclusively proved that ground nut variety GJG 32 recorded the higher yield (23.4 q ha⁻¹), followed by farmer's local variety recorded an average yield of (17.3 q ha⁻¹). HYV groundnut variety GJG 32 with proper nutrient management and plant protection measures gave 35.28 % higher over farmer's cultivation practices. The technological and extension gap was 8.6 q ha⁻¹ and 6.1 q ha⁻¹ respectively with technological index 26.88 percentages. The benefit cost ratio was 3.25 and 2.72 in case of GJG 32 and local variety respectively. Hence the existing local groundnut variety Jumkul can be replaced by HYV GJG 32 since it fits well to the existing farming situation for higher productivity in *kharif* season. By conducting on farm trails on small scale in farmer's field, yield potential of groundnut can be enhanced largely which will increase the income level of farmers and improve the livelihood condition of the farming community.

Keywords: *Groundnut; rainfed; on farm trails; Oilseed*

Floral diversity of Vallikkaattu Kaavu, Kozhikode, Kerala

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ABSTRACT

Flora of Vallikkaattu Kaavu sacred grove of Kozhikode District, Kerala, India with their botanical name, family, conservation status, endemic status, medicinal status and habit has been presented in detail. This sacred grove associated with the Sree Vana Durga Bhagavathi Temple located 20 km north of Kozhikode at Edakkara in Thalakkalathur Panchayat, is the largest sacred grove in Kozhikode District with an extent of 6.5 ha. A major portion of this sacred grove is a hillock with a perennial stream flowing through it draining into a pond close by makes this grove a wetland. The main deity of this temple is Sree Durga Bhagavathi and the sub-deities are Ganapathi, Ayyappan, Bhadrakaali and Sree Vettakkorumakan. Floristic studies of this sacred grove recorded 245 flowering species belonging to 209 genera and 77 families. Among the 245 species, 75 are herbs, 71 are trees, 55 are shrubs and 44 are climbers. Out of the 245, 44 are endemic - 16 endemic to Southern Western Ghats, 3 endemic to Southern Western Ghats (Kerala), 13 endemic to Western Ghats, 9 endemic to Peninsular India, 2 endemic to India and 1 endemic to South India (Kerala). Thirty four threatened plants were reported, out of which 3 are Critically Endangered, 5 are Endangered, 4 are Near Threatened, 1 is at Low Risk and Near Threatened, 16 are Vulnerable and 3 are with Data-Deficient status. Species with Not Evaluated status and Least Concern status were also listed. Endemic plants like *Sonerila rheedei*, *Litsea ghatica*, *Lagenandra meeboldii* and *Ischaemum tumidum* var. *calicutensis*, threatened and endemic plants like *Anaphyllum wightii* and *Kunstleria keralensis* and *Acorus calamus* L. with endangered status were recorded. *Myristica* swamps having dense prominent stilt and breathing roots represented mainly by *Gymnacranthera farquhariana* and the endemic and threatened species, *Myristica fatua* var. *magnifica* and *M. malabarica* were also recorded from this sacred grove. Out of the 245 species listed, 236 are medicinal, constituting 96% of the total flowering plants reported from this sacred grove.

Keywords: *Endemic; threatened; critically endangered; vulnerable; Gymnacranthera farquhariana; Myristica fatua* var. *magnifica*

Green and Sustainable Entrepreneurship**Ankita Kumari Yadav, Manoj Kumar , Sunita sondaliya and Harshvardhan Singh Purawat***Department of Animal Production, Rajasthan College of Agriculture, Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan, India.***ABSTRACT**

Green and sustainable entrepreneurship represents a progressive approach to business that combines economic success with environmental responsibility and social well-being. Unlike traditional entrepreneurship, which often prioritizes profit maximization, green entrepreneurs aim to create ventures that address pressing global issues such as climate change, pollution, resource depletion and social inequality. These businesses promote the use of renewable energy, eco-friendly materials, waste reduction techniques and circular economy models to minimize environmental impact.

Sustainable entrepreneurs focus not only on innovation and market opportunities but also on long-term environmental stewardship and ethical business practices. Their initiatives often involve green technologies, sustainable agriculture, clean energy and socially inclusive models that generate employment while preserving natural ecosystems. Governments and international organizations are increasingly supporting such ventures through policy frameworks, financial incentives and sustainability-driven incubators.

As the world faces mounting environmental and demographic challenges, green and sustainable entrepreneurship plays a crucial role in shaping a resilient and inclusive economy. It fosters responsible production and consumption patterns, supports rural and urban development, and contributes significantly to achieving the United Nations Sustainable Development Goals (SDGs).

Keywords: *Green entrepreneurship; sustainable business; environmental innovation; circular economy; renewable energy; climate change; eco-friendly startups; sustainable development; SDGs; ethical business*

Trend in Cost of Cultivation of Cotton: An Analysis**Prema Borkar***Gokhale Institute of Politics and Economics (Deemed University), Pune, India.***ABSTRACT**

The profitability of cotton cultivation is significantly influenced by the costs associated with its cultivation. Additionally, it impacts the livelihoods of over six million cotton producers, the majority of whom are small and marginal. As a result of declining profitability, there is an increasing level of dissatisfaction among Indian cotton producers. The net incomes have been adversely affected by the increase in production costs, yield stagnation, and volatile output prices. The objective of this investigation was to evaluate the profitability of cotton by identifying the trends in its costs and returns. The analysis was conducted using cost of cultivation data from the Directorate of Economics and Statistics for the years 1996-97 to 2023-24. The cost concepts method was employed to analyze the data. In order to ascertain the correlation between yield and production cost, production function analysis was implemented. The log-linear regression function was employed to estimate the yield elasticity of production cost. It was determined that the primary factor contributing to the cost increase was an increase in the wages of human labor. Another factor that contributed to the cost increase was fertilizers. The cost of cotton cultivation can be reduced by judicious use of fertilizers and selective mechanization to reduce human labor consumption. In order to mitigate the expense of cotton cultivation, it is imperative to implement low-cost inputs.

Keywords: *cotton; trends; cost of cultivation; input factors; human labour; fertilizer consumption*

Autoregressive Integrated Moving Average Approach for Prediction of Pulses in India**Prema Borkar***Gokhale Institute of Politics and Economics (Deemed University), Pune, Maharashtra. India.***ABSTRACT**

In the present paper, time series data were forecasted using the Auto-Regressive Integrated Moving Average (ARIMA) technique. The dataset used for modeling and forecasting was on pulses. The data for pulses production from 1970-71 to 2023-24 were available on the Department of Agriculture and Farmers Welfare, Government of India website. The model was developed and forecasted using the ARIMA technique. Only when the time series data is stationary can the ARIMA technique be applied. Because variations in the data make a time series non-stationary, this work also analyzes how to assess stationarity and convert non-stationarity into stationarity.

Finally, the model was constructed using a predetermined set of orders for autoregressive terms, moving average terms, differencing, and seasonality. Its predictive capabilities were evaluated and contrasted with the actual value. The model parameters were estimated using the R programming language. A variety of goodness-of-fit metrics were employed to evaluate the efficacy of the fitted model. The selected model is employed to generate projections for the period of six years i.e., from 2025 to 2030. The results of the pulses production were presented numerical and graphically. These estimations are exceedingly advantageous when it comes to adapting marketing and policy initiatives to account for forthcoming developments.

Keywords: *ACF - Autocorrelation Function; ARIMA – Autoregressive Integrated Moving Average; MAPE; PACF - Partial Autocorrelation Function; Residual Analysis; Pulses Production*

Eco-Thermal Enhancement of *Salix tetrasperma*: Strengthening Wood Properties for Climate Resilience**Sufiya Shabir¹, Dr. Bhupender Dutt², Dr. G.M. Bhat¹**

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ABSTRACT

The sustainable utilization of wood resources under a changing climate necessitates eco-friendly modification techniques that enhance physical and chemical properties without reliance on synthetic preservatives. Thermal treatment of *Salix tetrasperma* wood has emerged as a promising strategy to improve material performance in response to climate-driven challenges such as elevated decay pressure and fluctuating environmental conditions. In this study, wood samples subjected to thermal modification across a temperature gradient (60–200°C) exhibited significant alterations in their physical and chemical characteristics. Moisture content declined markedly from 192.03% in untreated wood to 140.09% at 200°C, while specific gravity increased from 0.401 to 0.515, reflecting enhanced density and reduced hygroscopicity. Dimensional stability improved, with volumetric shrinkage and swelling decreasing from 7.42% and 8.03% in controls to 3.42% and 3.85% at higher temperatures, demonstrating resilience against climate-induced variations in humidity. Chemically, extractive content, including cold and hot water solubles, increased notably at moderate temperatures, while alcohol-benzene extractives and lignin peaked at 200°C, indicating polymer breakdown and redistribution. Conversely, holocellulose content declined from 79.18% in the control to 70.89% at 200°C, evidencing degradation of cellulose and hemicelluloses under heat. These findings highlight thermal modification

as a sustainable approach to improving wood durability and stability under climate variability, supporting its role in promoting environmentally responsible material use in vulnerable ecosystems.

Keywords: *Thermal modification; Climate resilience; Dimensional stability; Chemical composition; Salix tetrasperma*

Floral diversity of Vallikkaattu Kaavu, Kozhikode, Kerala

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ABSTRACT

Flora of Vallikkaattu Kaavu sacred grove of Kozhikode District, Kerala, India with their botanical name, family, conservation status, endemic status, medicinal status and habit has been presented in detail. This sacred grove associated with the Sree Vana Durga Bhagavathi Temple located 20 km north of Kozhikode at Edakkara in Thalakkalathur Panchayat, is the largest sacred grove in Kozhikode District with an extent of 6.5 ha. A major portion of this sacred grove is a hillock with a perennial stream flowing through it draining into a pond close by makes this grove a wetland. The main deity of this temple is Sree Durga Bhagavathi and the sub-deities are Ganapathi, Ayyappan, Bhadrakaali and Sree Vettakkorumakan. Floristic studies of this sacred grove recorded 245 flowering species belonging to 209 genera and 77 families. Among the 245 species, 75 are herbs, 71 are trees, 55 are shrubs and 44 are climbers. Out of the 245, 44 are endemic - 16 endemic to Southern Western Ghats, 3 endemic to Southern Western Ghats (Kerala), 13 endemic to Western Ghats, 9 endemic to Peninsular India, 2 endemic to India and 1 endemic to South India (Kerala). Thirty four threatened plants were reported, out of which 3 are Critically Endangered, 5 are Endangered, 4 are Near Threatened, 1 is at Low Risk and Near Threatened, 16 are Vulnerable and 3 are with Data-Deficient status. Species with Not Evaluated status and Least Concern status were also listed. Endemic plants like *Sonerila rheedei*, *Litsea ghatica*, *Lagenandra meeboldii* and *Ischaemum tumidum* var. *calicutensis*, threatened and endemic plants like *Anaphyllum wightii* and *Kunstleria keralensis* and *Acorus calamus* L. with endangered status were recorded. *Myristica* swamps having dense prominent stilt and breathing roots represented mainly by *Gymnacranthera farquhariana* and the endemic and threatened species, *Myristica fatua* var. *magnifica* and *M. malabarica* were also recorded from this sacred grove. Out of the 245 species listed, 236 are medicinal, constituting 96% of the total flowering plants reported from this sacred grove.

Acknowledgements

The authors are grateful to Executive Director, Centre for Water Resources Development & Management (CWRDM), Kozhikode, Kerala, India for facilities and encouragement.

Keywords: *Endemic; threatened; critically endangered; vulnerable; Gymnacranthera farquhariana; Myristica fatua* var. *magnifica*

Empowering Climate Action Through Library And Information Science: Pathways For Knowledge Dissemination

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ABSTRACT

Climate change poses unprecedented challenges such as rising global temperatures, erratic rainfall patterns, frequent droughts, flash floods, glacial melt, and biodiversity loss, all of which threaten food

security, human health, and sustainable livelihoods. Addressing these challenges requires informed, evidence-based, and collaborative responses. Library and Information Science (LIS) plays a pivotal role in bridging the gap between scientific research and public understanding by enabling the systematic collection, organization, preservation, and dissemination of climate-related knowledge. LIS professionals curate credible resources from national and international agencies such as the Intergovernmental Panel on Climate Change (IPCC), Indian Meteorological Department (IMD), and Food and Agriculture Organization (FAO), and develop thematic repositories on issues like renewable energy adoption, climate-resilient agriculture, and disaster risk reduction. Multilingual access, open access databases (e.g., AGRIS), and digital platforms (e.g., NASA Earth Data) support wide-reaching information sharing. Community-based initiatives such as mobile libraries in drought-prone regions, KVK-led climate adaptation programs under NICRA, and farmer training on micro-irrigation technologies illustrate practical dissemination models. Capacity building, integration with early warning systems, and collaboration with extension services enhance knowledge uptake. Moreover, integration of LIS services with early warning systems, ICT-enabled weather advisory services, and e-agriculture platforms enhances timely decision-making at grassroots levels. Despite challenges such as limited funding, uneven digital infrastructure, and rapidly evolving scientific findings, LIS offers sustainable solutions through open data sharing, artificial intelligence-enabled analytics, and the blending of indigenous knowledge with modern science. By ensuring climate literacy and fostering informed participation, LIS emerges not merely as a custodian of information but as a strategic driver of climate action, resilience building, and sustainable development.

Keywords: *Library and Information Science (LIS); Climate change; Knowledge dissemination; Open access resources; Digital repositories; Community outreach*

Performance of Different Varieties of Cabbage under Prayagraj Agro-Climatic Conditions

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ABSTRACT

The experiment was conducted using Randomized Block Design (RBD) with 9 treatments and 3 replications at the Horticulture Research Farm, Department of Horticulture, Naini Agricultural Institute, SHUATS, Prayagraj. Among the tested varieties, Royal Ball (V2) performed best in terms of growth (plant height – 31.50 cm, number of leaves – 14.00, leaf length – 27.66 cm, leaf width – 26.11 cm), yield (head weight – 682.50 g, days to head maturity – 71.60, days to harvest – 75), and quality traits (TSS – 3.27 °Brix, Vitamin C – 33.23 mg/100g, leaf colour – green). The study concluded that Royal Ball is the most economically viable variety under Prayagraj agro-climatic conditions with the highest B:C ratio of 3.38.

Keywords: *Cabbage; Varieties; Growth; Yield; Quality*

Litchi Production in India: A Quick Overview

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Introduction

The Litchi (*Litchi chinensis* Sonn.) belongs to the Sapindaceae family and well known as the ‘Queen of fruits’. Litchi was originated in near South China and North Vietnam in the year 1500 BC but has now spread to different countries. The fruit was introduced in India about 100 years later through Burma, from which it has spread to

other parts of the tropical and subtropical areas of the country (Ghosh, 2000).

India is the 2nd largest producer of litchi in the world after China. It is one of the most famous fruit crops and mostly cultivated in the Eastern part of the country. In India, 568,200 metric tons of litchis are produced annually from 93,300 hectares (Anonymous, 2018) while the average productivity of litchi in the country is 6.1 t/ha in 2016-17.

Major Litchi producing states in India

The percentage of area and production of litchi in different states from the year 2011-12 to 2013-14 is shown in Table 1. It is clear that Bihar is the leading state in litchi production (40%) followed by West Bengal(16%) Jharkhand(10%), Assam(8.2%), Chhattisgarh(6.4), Uttarakhand(5.2%), Punjab(4.8%), Orissa(3.5%) and Tripura (3.4%) in 2013-14. Also, the state-wise value of the production output of litchi is presented in Table 1. below.

State	2011-12		2012-13		2013-14	
	% Area	% Production	% Area	% Production	% Area	% Production
Bihar	38.7	43.9	37.8	44.2	37.4	40
West Bengal	11.1	15.9	11.1	15.5	11	16
Jharkhand	6	10.7	6.4	10	6.3	10
Assam	6.6	7.7	6.8	8.6	6.4	8.2
Chhattisgarh	5.6	5	6	5.3	6.4	6.4
Uttarakhand	11.8	3.5	11.5	3.3	11.2	5.2
Punjab	2.1	4.6	2.1	4.6	2.2	4.8
Odisha	5.6	3.7	5.4	3.5	5.3	3.5
Tripura	4	3.1	4.2	3.1	4.6	3.4
Others	8.6	1.9	8.7	1.9	9.2	2.4

Climatic and Soil Requirements

Litchi crop is very specific to the climate requirement; probably because of this reason, its commercial cultivation is limited to few tropical and subtropical countries.

Litchi could not freely spread like other fruit crops because of its specific climate and soil requirement. It requires warm subtropics climate, short dry, frost-free winters and long hot summers along with high rainfall and humidity (Mitra and Pathak, 2008). The soil should be a well-drained loamy soil, rich in organic matter and having 5 to 7 pH range.

Harvesting and Arrival Season

India is gifted with unique ripening pattern of litchi, with harvesting period differs from state to state. The ripening of fruit commences from north-eastern part to the central part and then North to South India. Litchi is a seasonal fruit, typically harvested during May to June, depending on the region and variety. The fruits are picked when they turn bright red and are fully mature.

While time of arrival of litchi in Indian market varies according to the respective regions and climatic conditions which has been mentioned in following table 2.

S. No.	States	Season of availability
1	Tripura	15 th April to end of April
2	Assam	3 rd week of May
3	West Bengal	1 st May to 3 rd week of May
4	Bihar	3 rd week of May to 2 nd week of June
5	Jharkhand	3 rd week of May to 2 nd week of June
6	Uttarakhand	2 nd week of June to 4 th week of June
7	Punjab	3 rd week of June to last week of June
8	Himachal Pradesh	3 rd week of June to last week of June
9	Tamil Nadu	15 th December to 15 th January
10	Karnataka	15 th December to 15 th January
11	Kerala	15 th December to 15 th January

Economic Importance

Litchi cultivation supports the livelihoods of thousands of farmers. Bihar alone contributes over 40% of India's total litchi output. The fruit is sold fresh, and also processed into juice, pulp, jam, and canned products for domestic and export markets. According to the survey estimates in Bihar, about 80% of the total litchi produced in the state is being exported to the other states out of which the major markets are Delhi, Varanasi, Lucknow, Mumbai, Kanpur, Kolkata Chandigarh and Bangalore (Anonymous, 2010).

Challenges in Litchi Production

Lower productivity, poor nutrient management, biennial bearing of fruits, low shelf life are the major constraints with litchi cultivation among all varieties of litchi in India, while litchi farming faces challenges such as pest and disease attacks (like fruit borer and mites), climate change, and lack of proper cold storage and transport facilities which lead to post-harvest losses.

Conclusion

Litchi is an economically important fruit crop in India, especially in eastern states like Bihar. Despite its high market demand, issues like low productivity, pest problems, and poor post-harvest handling affect its potential. Addressing these challenges through improved practices and infrastructure can boost production and benefit growers significantly.

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Assessing the Impacts of Climate Variability on Crop Yields in Punjab, India: A Just-Pope Panel Data Analysis

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Purpose

Punjab's agriculture is highly vulnerable to climate change, with variations in temperature and rainfall directly affecting crop productivity and stability. The state depends heavily on wheat, rice, maize, and cotton, and therefore faces significant risks from changing climatic patterns. The purpose of this study was to assess the impacts of climate variability on both mean yields and yield risk across agro-climatic zones of Punjab, applying the Just-Pope production function to capture effects on productivity and variability simultaneously.

Material and Methods

The analysis used secondary data from 1990–2024 across five agro-climatic zones. Daily gridded climate data (Tmax, Tmin, rainfall) from IMD were aggregated to crop-specific growing seasons, and yield data were obtained from the Statistical Abstract of Punjab. Stationarity and cointegration tests

confirmed long-run relationships between yields and climate variables. The Just-Pope production function was estimated using Feasible Generalized Least Squares (FGLS) with zone fixed effects, separately modeling mean yield and variance functions.

Results

Yields of wheat, rice, and maize showed positive long-term trends, while cotton improved only slightly. Tmin increased consistently (+0.4 to +1.2°C), Tmax rose modestly, and rainfall declined significantly during rice and maize seasons. Wheat responded positively to Tmin but faced higher variability. Rice was negatively affected by Tmax and positively by Tmin, though variability increased with Tmin. Maize was highly sensitive to Tmax, with reduced yields and higher risk, while cotton yields benefited from Tmin but at the cost of greater instability. Elasticity estimates confirmed maize and cotton as the most climate-sensitive crops, while zone effects indicated weaker yields in sub-mountain areas and higher variability in western zones.

Conclusions

The study demonstrates that rising temperatures are the dominant drivers of both yield changes and yield risks in Punjab, while rainfall plays a comparatively smaller role. Rice and maize emerge as the most vulnerable crops due to warming Tmax and rainfall decline, whereas wheat and cotton show relative resilience in terms of yield but face increasing instability under rising Tmin. These findings highlight the importance of zone-specific adaptation measures, including the introduction of heat-resilient varieties, adjustment of sowing windows, improvements in irrigation efficiency, and the expansion of crop insurance schemes to protect farmers against rising climatic risks.

Keywords: *Climate change; Crop productivity; Just-Pope Production function; Yield variability; Climatic risks*

Smart Food and Nutri - cereals : A Nutritional revolution

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ABSTRACT

In the era of processed food and junk, after COVID-19 pandemic people around the world have become more aware about their health, quality food and the term “Nutri- cereal and Super food” gets popular. Basically nutri cereals are a group of nutrient rich grains primarily millets that contains high nutritional value including protein, fibre, minerals on the other hand SuperFood is a broader term which includes nutri-cereals, pulses, amaranth and other food which are good for you (nutritious), good for planet (sustainable), good for farmers (Economically viable). Now people are more aware about the proportion of carbs, protein, vitamins and minerals in their meals and millets meet all their needs.

Millets are intensively grown in Rajasthan, Karnataka ,Maharashtra among them Rajasthan holds 1st position in terms of area and production with area of 4.6 million hectare producing an average production of about 2.8 million tons Rajasthan is a leading producer of millets in India, particularly pearl millet (Bajra). According to the Rajasthan Millet Conclave 2023, the state cultivates approximately 4.6 million hectares of millets, yielding an average production of about 2.8 million tons, with a productivity rate of 400 kg per hectare. In the 2023-24 agricultural year, Rajasthan contributed 32% to India's total millet production, reflecting its favorable climatic conditions and extensive cultivation area.

India is entitled as “Diabetes capital of the world” with an estimate of 212 million people living with this condition and obesity is a rising concern. Millets are the best option to cure these issues as they contain nutritional bunch finger millet loaded with Ca , pearl millet contains Fe and rich in fibre best for anemia patients. Sorghum grains are gluten free, best for people affected by celiac disease (Allergic to gluten).

We should include millets in our daily diet There should be a separate niche for nutri-cereals in the market Govt. and other organisations should make efforts to popularise local millet cuisines like “Sogra” (Chapati made out of pearl millet flour) and pearl millet churma made with jaggery as a dessert which is really delicious and nutritious specially for anemia patients.

Keywords: *SuperFood; Nutri-cereals; quality food; millets*

Insects: Unsung Heroes of Our Ecosystem

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ABSTRACT

Insects are vital contributors to ecosystem services, providing essential functions such as pollination, decomposition, pest control and nutrient cycling. These services are crucial for maintaining biodiversity, soil health, and agricultural productivity. Despite their importance, insects are undergoing a significant decline, with estimates suggesting that millions of species remain unidentified, making it difficult to fully assess their ecological value. While the decline of bees has gained attention globally, the broader insect crisis has not yet sparked the necessary level of concern among conservationists. Insects also offer cultural and economic value, inspiring art, literature, and industries like honey and silk production. However, the loss of insect species represents more than just the disappearance of individual organisms; it disrupts the functioning of ecosystems by removing unique evolutionary histories and altering the dynamics of the food web. Current conservation efforts, which focus largely on vertebrates, largely neglect insects, despite their critical role in ecosystem stability. As the potential loss of up to half a million insect species looms, urgent action is needed to protect these creatures and preserve the essential services they provide. A greater emphasis on the preservation of insect biodiversity is crucial for maintaining ecosystem health and securing the long-term survival of both natural systems and human societies.

Keywords: *Insects; ecosystem services; biodiversity; conservation; decline*

Study of the Effect of Seasonal Variations on Physico-Chemical Analysis of Surface Water in the River Balan Stretches

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EXTENDED SUMMARY

Abstract

During the research, the physicochemical analysis of freshwater samples collected from various stretches of the Balan River was conducted across three different seasons: summer, winter, and monsoon. The study of physicochemical properties considered seasonal changes that influence the diversity of the water body. In this water body, a major source of nutrients is through hydrological and biological pathways. Hydrological inputs include the import of nutrients from surface runoff and

discharge from the upper stretch of the Kamala River. The parameters studied for physicochemical analyses of water included temperature, conductivity, pH, dissolved oxygen, free carbon dioxide, carbonate and bicarbonate alkalinity, hardness, chloride, calcium, magnesium, sodium, potassium, silica, nitrate, and phosphate. All these parameters vary according to seasonal fluctuations, and they influence the availability of different freshwater fish species and the EFA (omega-3 and omega-6) profiles of selected fish. The present study resulted in the development of an information system for identifying factors responsible for the presence of freshwater fish catches and aquatic fauna and their lipid profiles.

Keywords: *Physicochemical; seasonal change; lipid profile; pH; conductivity*

Observations

Collected data depict the physico-chemical features of the Balan river stretches. Perusal of the table reflects that the water condition of the river Balan is relatively less productive. The water color was dark green during the summer and winter seasons. The water temperature ranged between 20.40 – 32.20 °C and pH between 6.0 and 7.6, showing a little wide fluctuation. The conductivity during summer was as low as 196mhos/cm, which improved to 256mhos/cm during winter. The levels of dissolved O₂ and free CO₂ were comparable to Kamla being in the range of 5.2mg/l – 6.2 mg/l and 2.7 mg/l – 3.8 mg/l. Alkalinity, both in terms of carbonate and bicarbonate, varied between 16.6 mg/l – 22.0 mg/l and 98.0 mg/l – 121.0 mg/l, respectively. The chloride concentration was recorded between 7.2 mg/l – 11.2 mg/l, being maximum during winter and lowest during summer.

The calcium levels reflected a high value of 28.0 mg/l during winter and a low value of 17.6 mg/l during the monsoon season, while magnesium levels were high during summer at 8.9 mg/l and low during winter at 6.0 mg/l. A similar trend was observed in the case of sodium, which ranged between 13.6 mg/l – 16.2 mg/l. The levels of potassium and silicate varied between 1.43 mg/l – 4.2 mg/l, and 4.54 mg/l – 6.1 mg/l, respectively. The levels of phosphate and nitrate are in the range of 0.003 mg/l – 0.004 mg/l and 0.42 mg/l – 0.55 mg/l, respectively. According to seasonal variation and physicochemical changes directly influence the presence of aquatic fauna, by fish-variety and impact on their biochemical profiles.

Table – 1: Physico-chemical analysis of the surface water of the river Balan stretch in the village of Pohaddi during summer, monsoon, and winter seasons.

Characters	Summer	Monsoon	Winter	Range
Appearance	Normal	Normal	Normal	Normal
Water color	DG	NG	DG	NG to DG
Temp. (°C)	32.2	27.4	20.4	20.4 – 32.2
pH	6.0	7.3	7.6	6.0 – 7.6
Conductivity (mhos/cm)	196	212	256	196 – 256
Dissolved O ₂ (mg/l)	5.2	6.1	6.2	5.2 – 6.2
Free CO ₂ (mg/l)	3.8	2.7	2.1	2.7 – 3.8
Carbonate alkalinity (mg/l)	22.0	19.2	16.6	16.6– 22.0
Bicarbonate alkalinity (mg/l)	121.0	98.0	110.0	98.0 – 121.0
Chloride (mg/l)	7.2	11.0	11.2	7.2 – 11.2
Total hardness (mg/l)	105.0	78.0	88.4	78.0 – 105.0
Calcium (mg/l)	20.6	17.6	28.0	17.6 – 28.0
Magnesium (mg/l)	8.4	8.2	6.0	6.0 – 8.4
Sodium (mg/l)	16.2	13.6	14.1	13.6 – 16.2
Potassium (mg/l)	1.62	1.43	4.2	1.43 – 4.2

Silicate (mg/l)	6.1	4.54	5.4	4.54 – 6.1
Phosphate (mg/l)	0.004	0.003	0.003	0.003–0.004
Nitrate (mg/l)	0.98	0.55	0.42	0.42 – 0.55

Table 2: Details of common fish catch and other aquatic fauna from the rivers (Balan) during summer, monsoon, and winter seasons.

	Summer	Monsoon	Winter
Major catch more than 20-30%/ catch	Rohu (<i>Labeo rohita</i>) Naini (<i>Cirrhinus mrigala</i>) Catla (<i>Catla-catla</i>) Big head (<i>Aristichthys nobilis</i>) Saura (<i>Channa Maurulius</i>)	Rohu Naini Catla Katri (<i>L. calbasu</i>) Saura Garai (<i>C. punctatus</i>) Boari (<i>M. Seenghala</i>)	Rohu Naini Catla Big head Silver carp Suhia (<i>Gudusia chopra</i>) Chechra (<i>Ompak bimatulam</i>) Boari (<i>Mystus seenghala</i>) Boari (<i>Mystus aor</i>)
Minor catch 6-10%/ catch	Pothia (<i>Puntius chola</i>) Pothia (<i>Puntius savanna</i>) Gonch (<i>Bagariu bagarius</i>) Garai (<i>Channa straitus</i>) Mangur (<i>Clarias batrachus</i>) Chelwa (<i>Chelo at par</i>) Kauwa (<i>Xentodon concilla</i>) Rita (<i>Rita rita</i>) Boari (<i>M. Seenghata</i>) Boari (<i>M. aor</i>)	Garai Suhia Chechra Pothia Tengra (<i>Mystus Tenggara</i>) Boari Colisa (<i>Colisa fasiatus</i>) Reba (<i>Cirrhiunus reba</i>) Bata (<i>Labeo bata</i>) Gora (<i>Oxygastor gora</i>)	Pothia Tengra Boari Chela (<i>Chela atpar</i>) Singhi (<i>Heteropneustus fossilis</i>) Jhinga (<i>Macrobrachium maleolmsonii</i>) Chonda (<i>Changa nama</i>) Chanda (<i>Chanda ranga</i>) Bhunna (<i>Noropterus notopterus</i>) Bhu chatti (<i>Notopknus chitala</i>) Bata Reba
Miscellaneous less than 5%/catch	Tetrodon cutcutia Darhi (<i>Nandus nanduso</i>) Pryla Tortoise Snake Crab Unio Garai Kaua Ailia colia	Chenri (<i>Chanda nama</i>) Chenri (<i>Chanda ranga</i>) Darhi Pryla Tortoise large Snake Bulla (<i>Glossogobius giuriso</i>) Unio Pangesius pangeius	<i>Nandius nandus</i> Pyla Tortoise Snake Crab Unio Glossogobius giuris

Conclusion

Nutrients are carried into the water bodies through geological, biological, and hydrological pathways. Geological inputs include nutrients from the weathering of rocks. Biological inputs include the uptake of carbon and nitrogen through photosynthesis, nitrogen fixation, and the biotic transport of materials by animals. An ecosystem is considered biologically open when there is an abundant exchange of materials with its surroundings, as in the case of rivers and lakes. When there is little movement as observed in ponds, materials across the ecosystem boundary, it is said to be biologically closed (Mitsch and Gosselink, 1986). Like biochemical profile, the availability of fish species in general is highly variable depending upon their physiological status, environment, season, and availability of preferred food. Similarly, the biochemical profile of the fish is closely related to fish intake, behavioral pattern, and spawning (Halver, 2002). In particular, the lipid fraction is the component showing the greatest variation (Love, 1970). Seasonal variations in the fatty acid composition of fish species (Tables 1 to 3), as shown by total lipid content and iodine values, have been documented in many studies (Halver, 1998). The iodine value of fat indicates the average degree of saturation: the higher the iodine value, the more C=C double bonds are present. By definition, the iodine value is expressed as grams of iodine absorbed per 100 grams of lipid. The acid value measures the milligrams of KOH needed to neutralize the fatty acids in 1 gram of fat, while the saponification value indicates the milligrams of KOH required to neutralize the fatty acids after complete hydrolysis of 1 gram of fat. The saponification value offers insight into the nature of the fatty acids in the fat, since longer carbon chains produce less acid per gram of hydrolyzed fat. After studying the seasonal variations and the differences in the parameters of water according to seasons, the total hardness of water in the monsoon season was affected by the presence of fish species (major carp%), especially on the population of Bighead (*Aristichthys nobilis*) in the Balan river. Data on biochemical analysis of the collected fish of the Balan River stretches depict that in the case of *Labeo rohita*, the fat content, iodine value, triglyceride, and saponification value are maximum in the winter season, but acid value in the monsoon season; in *Labeo calbasu*, fat content and saponification value, and iodine value is maximum in winter but triglyceride in monsoon; in *Catla catla*, iodine value, saponification value and acid value is maximum in summer season, but fat in monsoon and triglyceride in monsoon.

Green Entrepreneurship With Banana Fiber in Manipur : From Waste to Weave

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EXTENDED SUMMARY

Introduction

Banana cultivation is widespread in Manipur, but large volumes of pseudostem biomass generated after harvest are often discarded or left to rot, causing environmental concerns. This agro-waste, however, is a rich source of strong, lustrous, and biodegradable fiber. Given Manipur's vibrant handloom and handicraft traditions, banana fiber offers a unique opportunity for sustainable entrepreneurship. The objective is to establish a circular, climate-positive business model that transforms banana waste into eco-friendly craft products while generating livelihoods, particularly for women and self-help groups (SHGs).

Materials and Methods

Farmers supply pseudostems to village-level processing units, where fibers are extracted using portable decorticators, bio-retted with eco-friendly methods, sun-dried and graded. Centralized hubs handle carding, spinning, and blending with muga, or cotton fibers. Natural dyeing with plant-based sources such as indigo, turmeric ensuring environmental sustainability. By-products—banana sheaths, sap, and short fibers—are further utilized for disposable plates, biofertilizers, and cushion fillings, ensuring near-zero waste. Capacity-building modules (40–60 hours) train artisans in fiber preparation, weaving, dyeing, and quality control. Product categories include. Textiles- shawls, stoles, wraps, Accessories- bags, belts, wallets, home décor- placemats, lampshades, wall hangings.

Results

Pilot trials revealed that 12–15 tonnes of pseudostems yield 300–500 kg of spinnable fiber monthly, supporting production of 250–350 items. Artisans adapted well to weaving banana fiber, especially when blended with softer fibers. Natural dyeing achieved satisfactory shades and durability. Environmental impact includes $\geq 60\%$ reduction in on-field waste and lower emissions. Socially, SHGs showed strong interest, viewing banana fiber crafts as culturally meaningful and economically beneficial.

Conclusions

Banana fiber valorization offers economic (new rural incomes), social (women empowerment), and environmental (waste reduction, biodegradable products) benefits. With policy support, infrastructure, and branding, Manipur can emerge as a hub for sustainable handloom and handicraft entrepreneurship, turning agro-waste into high-value “waste-to-weave” innovations.

Keywords: *Banana fiber; agro-waste valorization; handloom; handicrafts; circular economy; Manipur; women entrepreneurship*

Impact of Integrated Nutrient Management on Nutraceutical properties of finger millet.

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ABSTRACT

Finger millet (*Eleusine coracana* L.), considered as a “super cereal,” is gaining renewed attention for its remarkable profile of health-promoting, nutraceutical compounds. Rich in essential amino acids like lysine and methionine—rare in plant foods—along with high dietary fiber, vital minerals (notably calcium and iron), and an array of phytochemicals. Finger millet stands out as a functional food with the potential to combat malnutrition and chronic diseases including diabetes, cardiovascular conditions, and anemia. Integrated Nutrient Management (INM), which combines the use of organic, inorganic, and biofertilizer sources, is emerging as a transformative approach. By nurturing soil vitality and offering a more balanced nutrient supply, INM can foster better crop health and productivity. Importantly, recent research suggests that adopting INM can profoundly influence the nutraceutical qualities of finger millet by enhancing concentrations of beneficial phytochemicals (polyphenols, flavonoids) and minerals, and by improving antioxidative capacity and bioavailability of key nutrients. Integrated nutrient management impacts the composition and bioactivity of finger millet, focusing on the interplay between nutrient sources and the biosynthesis of health-promoting components. Emphasizing both scientific insight and practical implications. Use of INM not only improves the soil health but also helps in enhancing the quality of nutrients present in Finger millet.

Keywords: *INM; Finger Millet; Phytochemicals*

Panchagavya as a Foliar Biostimulant: Enhancing Growth and Yield of Bread wheat (*Triticum aestivum* L.)**Anjana Nautiyal and Moinuddin***Department of Agronomy, School of Agricultural Sciences, Shri Guru Ram Rai University, Dehradun, Uttarakhand, India.***ABSTRACT**

Sustainable agriculture is becoming increasingly vital in addressing global food security challenges while safeguarding environmental health. Wheat (*Triticum aestivum* L.), a staple crop worldwide, demands production practices that balance yield, profitability, and soil quality. Organic foliar sprays, particularly Panchagavya—an indigenous formulation derived from cow-based products—are gaining recognition as eco-friendly alternatives to chemical inputs. Panchagavya is rich in macro- and micronutrients, growth hormones, beneficial microbes, and bioactive compounds, which collectively enhance plant vigor, photosynthetic efficiency, and nutrient uptake. The present field experiment, was conducted during the Rabi seasons of 2022–23 and 2023–24 at the Crop Research Centre, Department of Agronomy, SGRR University, Dehradun (30.3165° N, 78.0322° E). The site is situated in the northwestern Himalayan foothills at an elevation of 640 m, characterized by a semi-arid to semi-humid climate. The effect of organic foliar sprays with Panchagavya on wheat revealed that the treatment T₁₆ (Panchagavya foliar spray @ 3% with 100% RDF) recorded the highest growth and yield attributes compared to the absolute control T₁. In T₁₆, plant height was 89.6 cm, whereas the control recorded 77.3 cm, showing an increase of 15.9 %. The number of tillers per plant increased to 7.5 in T₁₆, compared to 4.3 in the control, which is 74.4 % higher. The test weight improved to 46.2 g in T₁₆, as against 39.6 g in T₁, an increase of 16.7 %. Grain yield was significantly enhanced, with T₁₆ producing 5,089 kg/ha, while the control recorded only 3,246 kg/ha, reflecting a rise of 56.8 %. Similarly, straw yield increased to 7,231 kg/ha in T₁₆ compared to 5,016 kg/ha in T₁, marking an increase of 44.2 %. Grain protein content was also higher in T₁₆, recording 12.4% against 9.8% in the control, showing a 26.5 % improvement. These results clearly establish that foliar application of Panchagavya at 3% in combination with 100% RDF (T₁₆) is a promising practice to improve growth, yield, and quality of wheat while sustaining soil health. Results revealed that foliar application of Panchagavya significantly enhanced plant height, tiller number, leaf area index, and dry matter accumulation compared to control treatments. Yield attributes, including spike length, number of grains per spike, and test weight, were markedly improved, leading to higher grain and straw yields. The combination of 100% recommended dose of fertilizers (RDF) with 3% Panchagavya foliar spray demonstrated superior performance, recording maximum productivity and profitability while improving soil microbial activity, organic carbon, and nutrient availability. Statistical analysis of the data was carried out using ANOVA, and the treatment means were compared at a 5% level of significance to validate the results. The findings suggest that Panchagavya acts as both a biostimulant and a soil health enhancer, thereby contributing to sustainable wheat cultivation in the Northwestern Himalayan region. Its integration with nutrient management practices offers an economically viable and environmentally safe strategy for boosting wheat productivity while maintaining soil resilience.

Keywords: *Panchagavya; wheat; foliar spray; soil health; organic farming; sustainability*

Climate Change and Its Impact on Livestock Production Management: Challenges and Adaptation Strategies**Sunita Kumari Gurjar, Avinash Gurjar***Department of Animal Production, Rajasthan College of Agriculture, Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan, India.***ABSTRACT**

Climate change is emerging as one of the most significant threats to global livestock production systems, affecting animal health, productivity and farm economics. Rising temperatures, altered rainfall patterns and increased frequency of extreme weather events directly influence feed availability, water resources, disease dynamics and reproductive performance in livestock. Indirect impacts include changes in pasture quality, forage yields and the geographical spread of pests and pathogens. Heat stress not only reduces growth rates, milk yield and fertility but also compromises immune function, increasing susceptibility to diseases. These challenges necessitate a shift in livestock production management towards climate-resilient practices. Strategies such as improved housing design, genetic selection for heat tolerance, precision feeding, sustainable pasture management and efficient water use are critical. Integrating early-warning systems, animal health surveillance and low-carbon emission practices can further mitigate climate risks. This paper discusses the multifaceted impacts of climate change on livestock production and outlines adaptive management approaches essential for ensuring food security, farmer livelihoods and environmental sustainability in a changing climate.

Keywords: *Climate change; Livestock production; Heat stress; Animal health; Adaptation strategies and Sustainable management*

Effectiveness of Learning Styles of Higher Education students Study Pattern in Kolar District of Karnataka State**Jayalaxmi B Pawar¹, Pushpa P², Nandini B³ and Ganga Yenagi⁴***¹Department of Agricultural Extension, College of Horticulture, Kolar, University of Horticultural Sciences, Bagalkot, Karnataka, India.**²Department of Agricultural Extension, College of Horticulture, Sirsi, University of Horticultural Sciences, Bagalkot, Karnataka, India.**³GPB, University of Agricultural Sciences, Dharwad, India.**⁴Department of Agricultural Extension, University of Agricultural Sciences, Dharwad, India.***ABSTRACT**

Learning style, as an integral and vital part of a student's learning process, has been constantly discussed in the field of education and pedagogy. Learning styles play a vital role in the learning process and contribute to the overall educational environment. Therefore the study was conducted in Kolar of Karnataka State. Total sample size of 250 respondents were selected through purposive sampling technique. The results revealed that most of them were from rural areas with good academic performance. It is evident from results that, majority of the respondents 56.00 per cent were having visual type of learning style more than half of the population might follow visuals namely reading books, newspapers, posters, maps followed by thirty three per cent of respondents were categorized under auditory type of learning style with recorded lecture notes, hearing from friends during preparation for exam and a small portion only ten per cent of the respondents were having a kinesthetic type of learning style which was very rare learning style who will be more active and follow movement. The findings of the study also revealed that learning styles do not have a significant influence on academic performance and time spent for self-study. Therefore it can be concluded that Learning styles can be

simply understood as the various techniques that respondents prefer to use to perceive and process information and interact with the learning environment.

Keywords: *Learning styles; Higher Education; Academic performance; learning environment*

Ebselen Induced Wound Healing is Possible Therapy Against Mercury Induced Nephrotoxicity
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EXTENDED SUMMARY

Purpose

Mercury (Hg), a pervasive environmental pollutant. It exerts severe nephrotoxic effects by increasing oxidative stress, disrupting extracellular matrix organization, and compromising epithelial structural integrity. Methylmercury (MeHg), its most bioavailable and toxic form which induces epithelial-to-mesenchymal transition (EMT), contributing to progressive renal injury. Ebselen, an organoselenium compound with potent antioxidant and cytoprotective activities, has shown promise in preventing heavy-metal-induced oxidative damage. This study aimed to evaluate whether Ebselen can mitigate MeHg-induced nephrotoxicity by promoting wound healing, suppressing oxidative stress, and preserving epithelial phenotype in a renal epithelial cell culture model.

Materials and Methods

Rat kidney epithelial cells (NRK52E) were exposed to 0, 0.5 and 1 μ M MeHg concentration, alone and in combination with Ebselen. Cell viability was quantified using the MTT assay and reactive oxygen species (ROS) production was measured with the DCFDA assay. Scratch assay was performed to evaluate cell migration and repair capacity, and invasion assay was used to assess alterations in epithelial barrier properties. Gene expression levels of E-cadherin, vimentin, MMP9, VEGF were analyzed using real-time PCR and immunocytochemistry was used to monitor EMT-related changes. Creatinine release into the culture medium was measured as a functional biomarker of renal cellular injury.

Results

MeHg exposure led to a marked reduction in cell viability, significant elevation of ROS, impaired wound closure, and increased invasiveness. Molecular analysis demonstrated strong downregulation of E-cadherin alongside upregulation of vimentin, confirming EMT induction and loss of epithelial integrity. Immunocytochemistry further revealed cytoskeletal reorganization and disassembly of intercellular junctions. Elevated creatinine levels corroborated functional impairment of the renal cells. In contrast, Ebselen co-treatment substantially restored cell viability and suppressed ROS accumulation. The wound healing assay demonstrated improved cell migration and enhanced closure of scratch defects, while invasion assays confirmed reduced disruption of the epithelial barrier. Ebselen normalized E-cadherin expression, decreased vimentin levels, and preserved cytoskeletal organization, indicating reversal of EMT. Furthermore, creatinine levels returned to near-control values, highlighting protection against MeHg-induced functional damage.

Conclusion

This study demonstrates that Ebselen effectively counteracts MeHg-induced nephrotoxicity by attenuating oxidative stress, preserving epithelial characteristics, and enhancing intrinsic wound healing capability. Through a combination of cytotoxicity assays, oxidative stress measurements, EMT marker analysis, and functional biomarker evaluation, Ebselen emerges as a potent candidate for therapeutic intervention against mercury-mediated renal injury. These findings provide strong mechanistic evidence that antioxidant therapy can prevent matrix remodeling and epithelial integrity loss during toxic metal exposure. Further in vivo validation and pharmacological optimization are warranted to confirm its translational potential as a nephroprotective agent.

Keywords: *MeHg; Ebselen; e-cadherin; vimentin; MMP9; VEGF*

Economic Growth, Globalization, and Sustainable Tourism**Deepak Kumar Jain***Department of Agricultural Economics and Management, Rajasthan College of Agriculture, MPUAT, Udaipur, Rajasthan, India.***ABSTRACT**

Globalization has facilitated the movement of people, capital, and ideas across borders, creating opportunities for tourism expansion and contributing to national and regional economic growth. Tourism serves as a driver of employment, income generation, and infrastructure development, especially in developing economies. However, rapid globalization and unregulated tourism growth often lead to socio-cultural disruptions, environmental degradation, and unequal distribution of benefits. Sustainable tourism emerges as a balanced approach, aiming to harmonize economic benefits with cultural preservation and environmental conservation. By integrating sustainable practices, governments, businesses, and local communities can enhance the resilience of the tourism sector while ensuring long-term economic viability. The paper concludes that while globalization amplifies opportunities for tourism-driven growth, embedding sustainability principles is essential to achieving inclusive and environmentally responsible development.

Keywords: *Globalisation; Sustainable; Tourism and socio cultural*

Comparative evaluation of nutritional and hormonal intervention on the reproductive performance of repeat breeding cross breed cows in Jehanabad**Dinesh Mahto, Muneshwar Prasad, Abhay Kumar, Nirala Kumar and Virsha Kumari***Krishi Vigyan Kendra, Gandhar, Bandhuganj, Jehanabad, B.A.U, Sabour, Bihar, India.***ABSTRACT**

The present investigation was carried out to study the Comparative evaluation of nutritional and hormonal intervention on the reproductive performance of repeat breeding cross breed cows. A total forty repeat breeding cross bred cows were selected at organized Dairy farmers at Jehanabad district. Use of cows hormonal treatment along with supplementation of any Minerals and others dewormer was given to TOI : Control group : Dewormer (Fenbendazole 3g) orally , TO II: Fenbendazole (3g) +Mineral mixture (50g/day/animal for 30 days) orally ,TO III: Fenbendazole (3g) + Hormone (Double synchronization protocol), TO IV: Dewormer (3g) + Hormone (Estra-double synchronization protocol). All the repeat breeding cross bred cows were maintained under similar conditions in terms of feeding and other manage mental provisions. The occurrence of heat in all the groups of treatment of repeat breeding cross bred cows and the conception rate after insemination at estrus period /heat period was 40%, 60% and 50 % in group II , II, and IV respectively as compared to control groups 30% . It is concluded that Ovsynch protocol along with mineral mixture supplement improvement the conception rate in repeat breeding cross breed cows.

Keywords: *Repeat breeding; Cows and Hormone*

Efficacy of double injection Buserelin (GnRH) in Estrus repeats breeding crossbred cows**Dinesh Mahto, Muneshwar Prasad, Abhay Kumar, Sunil Kumar and Nirala Kumar***Krishi Vigyan Kendra, Gandhar, Bandhuganj, Jehanabad, B.A.U, Sabour, Bihar, India.***ABSTRACT**

The selected thirty 4 to 5th time repeat breeding crossed breed cows from different block of Jehanabad district of Bihar. Its divided into three groups and each groups equally distributed ten animals Group I: (Single injection):- injection Buserelin 20 µg (5 ml) I/M, 6 h before the AI, Group II: (Double injection):-1st injection of Buserelin 20 µg (5 ml) I/M , 6 h before the AI and 2nd injection on day 12 after last insemination. Control Group III: Only dewormer (Fenbendazole 3g) and Mineral mixture (50 g) daily for 30 days orally . All the repeat breeding cross bred cows were maintained under similar conditions in terms of feeding and other manage mental provisions. The occurrence of heat in all the groups of treatment of repeat breeding cross bred cows and the conception rate after insemination at estrus period /heat period was 40%, 50% in group I and II respectively as compared to control groups 20% . It is concluded that double , 1st injection of Buserelin 20 µg (5 ml) I/M , 6 h before the Artificial insemination and 2nd injection on day 12 after last insemination along with mineral mixture supplement for improvement the conception rate in repeat breeding cross breed cows.

Keywords: Repeat breeding; Cows and Hormone (Buserelin)

Response of microbial consortium For Improvement in productivity of safflower**S.A. Shinde, N.E.. Jayewar, R.R. Dhutmal, A.M. Misal and M.R. Magar***Vasantrao Naik Marathwada Krishi Vidyapeeth Parbhani, Maharashtra, India.***ABSTRACT**

Experiment was conducted at research farm of AICRP on safflower, VNMKV, Parbhani during *rabi* seasons 2023-24, To study the response of microbial consortium for improvement in productivity of Safflower in Soybean-Safflower Cropping System. In *Kharif* season soybean and in *Rabi* season safflower crop was sown. This experiment was conducted in Randomized Block Design with three replications. The treatment consists of T₁-100% RDF NPK, T₂- 75% RDF NPK, T₃- 75% RDF NPK + Elemental Sulphur, T₄- 75% RDF NPK + Bio Sulphur, T₅- 75% RDF NPK + GrowSulf, T₆- 75% RDF NPK + EndoSulf, T₇- 75% RDF NPK + Elemental Sulphur + Bio Sulphur, T₈- 75% RDF NPK + Elemental Sulphur + GrowSulf, T₉- 75% RDF NPK + Elemental Sulphur + EndoSulf. The result revealed that Recommended dose of fertilizer of crop was compared with reduced level of fertilizers in combination with elemental sulphur and different microbial consortium seed treatment, in this treatment T₈ i.e. 75 % RDF +Elemental Sulphur+ growsulf recorded highest growth attributes as well as yield of safflower. Seed yield of safflower (1961 Kg/ha) found significantly superior over rest of the treatments with and without microbial consortium seed treatment. Similar trend was observed in economics of safflower.

Climate Change and Horticulture: Emerging Risks and Resilient Strategies**Gulab Kumawat***Department of Horticulture, Rajasthan Agricultural Research Institute (SKNAU), Jobner, Durgapura, Jaipur, Rajasthan, India.***ABSTRACT**

The impacts of climate change are increasingly evident in horticulture, where crop growth, productivity, and quality are highly dependent on environmental conditions. Rising temperatures, irregular rainfall, frequent droughts, and shifts in pest and disease incidence are creating major challenges for fruit, vegetable, and ornamental production. Although higher atmospheric carbon dioxide can, in some cases, stimulate plant growth, this advantage is often offset by heat stress, water limitations, and declines in nutritional value. To address these issues, protected cultivation systems such as polyhouses, shade structures, and hydroponic setups have emerged as effective options to stabilize production under variable climates. At the same time, approaches like precision irrigation, integrated crop management, and the use of climate-resilient varieties are gaining importance. Advances in biotechnology, nanoscience, and digital agriculture offer further opportunities to minimize risks and support adaptation. Ensuring future sustainability, however, will require region-specific strategies, policy support, and active involvement of growers.

Keywords: *Climate change; horticultural crops; resilience; protected cultivation; sustainable production*

Government Policies for Sustainable Agriculture: Balancing Productivity, Resilience, and Social Equity**Sonali Khatai***Division of Agricultural Economics & ABM, Faculty of Agriculture, SKUAST-J, Chatha, Jammu, India.***ABSTRACT**

Agriculture sits at the centre of the climate-livelihood nexus, particularly in the Global South where farming sustains both food systems and rural incomes. In recent years, governments have introduced a wide range of policies including input subsidies, minimum support prices (MSPs), crop insurance, incentives for organic and natural farming and climate-smart schemes with the aim of making agriculture more sustainable. However, the effectiveness of these policies often varies, shaped by how they are designed, implemented, and received by farmers. This study explores the evolving landscape of government policies for sustainable agriculture, drawing on lessons from India and global experiences. Evidence indicates that while conventional input subsidies and price supports can raise short-term productivity, they often lock farmers into resource-intensive practices that degrade soil health, water resources, and biodiversity. By contrast, decoupled payments tied to environmental conditions and performance-based support schemes show promise in aligning farmer incentives with environmental sustainability and long-term resilience. India illustrates these trade-offs clearly. While ₹838 billion has been invested in climate-smart initiatives, fertilizer subsidies alone reached ₹70,000 crore in 2016–17. Yet targeted reforms, such as neem-coated urea, which cut fertilizer use by 6% while raising yields by 5%, solar pumps that could save 25 million tonnes of CO₂, and practices like System of Rice Intensification (SRI) and millet diversification show how productivity, income, and resource conservation can be achieved together. Sustainable agriculture policy is not only about reallocating subsidies, but also about integrating equity, access, and farmer participation into decision-making. Placing smallholders, women, and marginalized groups at the core of these frameworks is vital for transitions to be just and lasting. Ultimately, sustainable agriculture cannot be achieved through technology or economics alone, it demands coherent policies that balance productivity, environmental stewardship, and social well-being.

Keywords: *Sustainable agriculture; Input subsidies; Minimum Support Prices (MSPs); Climate-smart agriculture; System of Rice Intensification (SRI); Policy reforms*

Government Policies for Sustainable Agriculture

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ABSTRACT

Sustainable agriculture has become a key part of ensuring food security, protecting the environment and supporting rural areas. Governments around the world are playing a major role in helping this shift happen by creating policies, offering financial help and setting up systems that support it. This paper brings together information from different countries to show how policies are changing to support sustainable farming. The results show that when money and rules are designed with the environment in mind, they can help reduce harm to the planet, encourage organic farming and improve life in rural areas. Countries in the OECD and G20 have shown that when support for farming is not tied to how much is produced but instead linked to protecting the environment, like limiting the number of animals on farms, productivity and environmental health both improve. In India, lessons show that helping farmers with things like managing water resources, using efficient irrigation, having insurance and getting advice helps them deal with climate challenges. India has invested ₹838 billion in these kinds of projects, showing how important smart investments can be. However, the study also shows that when programs are not well connected or when farmers aren't involved, the results aren't as strong. The paper suggests that policies need to work together, involve the people who live in rural areas and be adapted to the needs of different regions, especially places that haven't been studied much, like parts of South America. By looking at what has worked and what hasn't, the paper shows that policies that are well-planned, include everyone and care about the environment are not only important for making farming more productive but also for making sure food systems can handle the challenges of climate change. These findings give useful guidance to those making policies, working on the ground and organizations that want to support a more sustainable future for agriculture.

Keywords: *Sustainable agriculture; Government policies; Rural development; Food security; Climate smart agriculture & Productive growth*

The Golden Nut Of Mithila: A Socio-Economic Study Of Makhana Farming In Bihar

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ABSTRACT

This paper provides a comprehensive review of the makhana (*Euryale ferox*) industry in Bihar, highlighting its significant role in the state's and India's economy, as well as the key challenges and opportunities for its sustainable growth. Bihar is the global leader in makhana production, contributing 85% of India's total yield. However, the industry is plagued by a variety of constraints across its value chain. The economic analysis of makhana cultivation reveals that despite being highly profitable, farming is a labour-intensive endeavour with high variable costs. For instance, in Darbhanga and Madhubani districts, human labor alone accounts for over 58% of the total cost, with the average cost of cultivation being Rs. 57,370.50 per hectare. Fixed costs, such as pond rent, are also a significant expense. The high gross returns (Rs. 171,630/ha) and a favourable Benefit-Cost ratio of 1.52 demonstrate the crop's immense potential for improving the livelihoods of marginalized communities

like the Mallah (fishermen). Despite the high profitability, the industry faces severe production, processing, and marketing constraints. Production challenges include the lack of pond ownership, limited access to credit and improved seed varieties, and a lack of scientific knowledge among farmers. Processing is hindered by the absence of modern machinery and the health risks associated with traditional roasting methods. Market limitations include price fluctuations and a disorganized, inadequate market infrastructure. The study also explores the socio-psychological profile of farmers and their attitude towards makhana-based farming systems. The majority of farmers show a favourable attitude towards this system, indicating a strong predisposition to adopt practices that could enhance production and income. However, a significant number of these farmers lack formal training, highlighting a critical gap. To ensure the long-term sustainability of the industry, the paper suggests several key interventions. These include the development of modern harvesting and processing tools, improving market infrastructure, and linking farmers with Micro Finance Institutions for timely credit. Additionally, promoting makhana as an organic product and obtaining a Geographical Indication (GI) tag could boost its market value and protect traditional knowledge. Finally, the integration of makhana cultivation with aquaculture and other field crops represents a promising avenue for a more sustainable and integrated farming system.

Keywords: *Makhana; Economic Analysis; Constraints; Sustainable Agriculture; Livelihood; Bihar*

Strategies for Enhancing Farmer Incomes: Pathways to Sustainable Agricultural Growth

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ABSTRACT

Boosting the income of farmers is crucial for achieving rural prosperity and ensuring the sustainability of agriculture. Farmers frequently encounter ongoing challenges such as small land sizes, increasing input expenses, restricted market access, and significant post-harvest losses. These difficulties, along with climate-related risks and price volatility, contribute to keeping farm incomes low and unpredictable. To address these obstacles, strategies should aim at both enhancing productivity and maximizing the value derived from agricultural products. Enhancing productivity can be accomplished by adopting better seed varieties, utilizing precision farming methods, optimizing input usage, and mechanizing processes suitable for small farms. Diversifying into high-value crops, livestock, horticulture, and related activities offers additional income sources and reduces reliance on a single crop. Effective post-harvest management through improved storage, grading, and processing facilities can reduce losses and boost returns. On the marketing front, empowering farmer producer organizations (FPOs), creating digital platforms, and connecting farmers to modern value chains enhance their bargaining power and market access. Access to affordable credit and crop insurance schemes enables farmers to manage financial risks and invest in productivity-boosting technologies. Government initiatives like minimum support prices (MSPs), contract farming frameworks, and the promotion of agri-entrepreneurship also offer stability and growth prospects. Sustainable income growth further necessitates skill development and capacity building, allowing farmers to adopt new technologies and explore non-farm opportunities. Collectively, these strategies establish a thorough approach to either doubling or significantly boosting farmers' incomes. By combining productivity improvements with involvement in the value chain, policy backing, and empowering farmers, sustainable agricultural development and rural prosperity are ensured.

Keywords: *Farmer income; value chains; diversification; rural livelihoods*

Managing the Impacts of Droughts, Floods, and Shifting Rainfall Patterns on Agriculture and Food Security**Somiya Kaur Sodhi¹, Sahil Naik², Harshit Ramotra³***SKUAST Jammu, Jammu and Kashmir, India.***ABSTRACT**

Agriculture in numerous areas is becoming more vulnerable to climate fluctuations, with droughts, floods, and changing rainfall patterns posing significant threats to food security and rural livelihoods. Droughts lead to reduced soil moisture, hinder groundwater replenishment, and cause substantial yield losses, while floods result in crop damage, soil erosion, and long-term land degradation. Irregular rainfall patterns further disrupt crop cycles and add uncertainty to farm planning. Collectively, these elements heighten production risks and undermine the resilience of farming communities, especially smallholders who lack access to resources and safety nets. Addressing these challenges effectively requires integrated strategies that blend short-term coping mechanisms with long-term adaptation plans. On the resource front, water harvesting structures, micro-irrigation systems, and watershed development projects can enhance water-use efficiency and decrease vulnerability. On the crop front, encouraging drought- and flood-resistant varieties, adjusting sowing schedules, and adopting climate-smart agricultural practices boost adaptive capacity. Technology-driven solutions like weather forecasting, satellite monitoring, and digital advisory services improve preparedness and facilitate timely decision-making. Institutional and policy support is crucial as well. Strengthening crop insurance programs, enhancing disaster relief frameworks, and promoting community-based adaptation strategies help mitigate risks for farmers. Simultaneously, long-term investment in sustainable water and land management ensures agriculture can endure future climate shocks. By integrating scientific innovation, farmer participation, and policy interventions, it is possible to protect food production and sustain the stability of rural livelihoods amid uncertain climatic conditions..

Keywords: *Climate variability; water management; resilient agriculture; food security***Organic Farming and Residue-Free Food Production: Building Trust, Ensuring Nutrition, and Advancing Food Security****Aroma Rana***Agri-Business Management, SKUAST-J, SKUAST Jammu, Jammu and Kashmir, India.***ABSTRACT**

The production of food without residue and organic farming are becoming more widely acknowledged as sustainable answers to the escalating issues of environmental degradation, food safety, and health. Growing public awareness of the detrimental effects of synthetic pesticides, fertilizers, and additives on soil fertility and human health has led to a search for better and cleaner substitutes. Based on environmentally friendly methods including crop rotation, composting, and biological pest control, organic farming guarantees long-term agricultural productivity while also enhancing soil health and biodiversity. Likewise, residue-free food manufacturing ensures that there are no chemical residues in the food we eat, lowering health risks and promoting healthier living. When combined, these strategies help to rebuild consumer confidence, advance food security, and aid international initiatives to address soil degradation and climate change. In addition to having positive effects on the environment and human health, these practices support fair trade, give farmers financial opportunities, and support sustainable development objectives. As a result, organic and residue-free farming are not merely farming methods; rather, they are a whole movement that aims to create safer food systems, healthier communities, and a more resilient planet.

Keywords: *Organic farming; residue-free food; sustainability; soil health; consumer trust; food safety; eco-friendly practices; nutrition; biodiversity; sustainable agriculture; climate resilience; food security*

Precision Agriculture and Soil-Water Conservation Innovations: Pathways to Sustainable Agriculture and Food Security**Kritika Sharma***Agricultural Economics, SKUAST-J, SKUAST Jammu, Jammu and Kashmir, India.***ABSTRACT**

Agriculture today faces increasing challenges due to shrinking water resources, declining soil fertility, and climate variability, making efficient resource management essential for sustainability. Precision agriculture, with its reliance on advanced tools such as remote sensing, GIS, drones, and IoT-based sensors, enables site-specific crop management, optimizes input use, and minimizes resource wastage. At the same time, soil and water conservation innovations-including contour farming, mulching, conservation tillage, rainwater harvesting, and micro-irrigation systems play a critical role in reducing soil erosion, enhancing water-use efficiency, and maintaining soil health. Together, these approaches not only improve crop productivity and farm profitability but also strengthen resilience against climate-induced risks such as droughts, floods, and irregular rainfall. By integrating technology-driven solutions with traditional conservation practices, precision agriculture fosters adaptive capacity, supports sustainable intensification, and reduces environmental degradation. Institutional support, capacity building, and policy incentives are equally crucial to promote adoption and scale up these innovations. Strengthening extension services, facilitating digital advisory platforms, and encouraging climate-smart practices will ensure long-term sustainability of agriculture and food security.

Keywords: *Precision agriculture; soil and water conservation; sustainable intensification; climate resilience; food security*

Hi-tech horticulture, Food processing, and Value addition**Sidharth Mahajan¹, Harshit Ramotra², Somiya Kaur Sodhi³***^{1,2}Agricultural Economics, SKUAST-J, ³Agri-Business Management, SKUAST-J, SKUAST Jammu, Jammu and Kashmir, India.***ABSTRACT**

In recent years, advanced horticulture, food processing, and value addition have become pivotal in transforming agriculture, fostering rural development, and ensuring food security. Advanced horticulture incorporates cutting-edge technologies like protected cultivation, precision agriculture, micro-irrigation, biotechnology, and climate-smart methods to boost productivity, optimize resource use, and improve crop quality. These advancements facilitate continuous production, reduce climate-related risks, and provide farmers with higher returns through efficient input utilization. Alongside, the food processing industry significantly enhances the value of raw produce by extending shelf life, improving nutritional content, and creating a variety of market-focused products. Processing not only curtails post-harvest losses but also creates jobs, strengthens supply chains, and opens export opportunities, thus benefiting the national economy. Value addition, through activities such as grading, packaging, branding, and product diversification, connects farms to markets, ensuring better prices for producers and catering to changing consumer demands. The integrated development of advanced horticulture with food processing industries forms a synergistic system where technological advancements in production are seamlessly linked with processing, marketing, and consumption. This comprehensive approach is crucial for tackling issues like smallholder inclusion, market volatility, and sustainability challenges. In India, where horticulture plays a significant role in agricultural GDP, promoting advanced practices and food processing is essential for doubling farmers' income and achieving nutritional security. Therefore, the combination of advanced horticulture with food processing and value addition holds great promise for transforming agriculture into a more resilient and competitive sector, and market-driven sector, ensuring long-term socio-economic benefits for farmers and consumers alike.

Keywords: *Hi-Tech Horticulture; value addition; food processing; crop quality*

Climate impacts on pests, diseases and management strategies

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ABSTRACT

Climate change significantly influences the dynamics of agricultural pests and diseases, posing serious threats to global food security and crop production. Rising temperatures, altered precipitation patterns and increased frequency of extreme weather events directly affect pest distribution, life cycles and the severity of disease outbreaks. Warmer climates may lead to expanded geographical ranges for many insect pests and pathogens, facilitating the emergence of new pest-disease complexes in previously unaffected areas. These shifts challenge existing management practices and demand adaptive strategies. Integrated Pest Management (IPM) approaches must evolve to incorporate climate-resilient practices, including predictive modeling, pest-resistant crop varieties, biological control methods and improved monitoring systems. Furthermore, climate-smart agriculture and the use of advanced technologies like remote sensing and AI-driven forecasting can help mitigate the impact. A coordinated effort involving research, policy-making and farmer awareness is essential to develop sustainable, flexible and proactive pest and disease management systems under changing climate conditions.

Keywords: *Climate change; Pests, Plant diseases; Integrated Pest Management (IPM)*

Abiotic and biotic stress management under climate change in horticulture crops

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ABSTRACT

With its swift and unpredictable effects, climate change poses a danger to sustainable agriculture and makes it more difficult for farmers and agricultural researchers to adapt to biotic and abiotic stressors. The possible impact of global climate change on plant-pest populations would depend on the interplay of climate variables such as temperature, precipitation, humidity, and other elements including soil moisture, atmospheric CO₂, and tropospheric ozone (O₃). These variables can have direct effects on plants or systemic effects, including changes in the predominance of insect pests, which can lead to differences in horticulture crops production.

Human activity-induced increases in atmospheric carbon dioxide (CO₂) have an impact on both the seasonality, length, and intensity of rainfall, as well as the occurrence of more droughts, waterlogging, and enhanced evapotranspiration. This has a detrimental effect on the growth, production, and quality of the plants cultivated in this environment. The study of plant stressors, how they react to various types of stress, and plant stress management techniques has been prompted by efforts to create stress-tolerant or resistant plants and boost agricultural yield. The many abiotic stressors that plants face and how climate change is affecting them, how these plants react to various abiotic pressures or a combination of stresses, and how to handle abiotic stress have all been covered in length in this chapter.

Keywords: *Abiotic and biotic stress; Climate change; Horticulture crops*

Population Dynamics of Whitefly, *Bemisia tabaci* in Bt cotton and its correlation with weather parameters**Sheetal Kumawat*, B.L. Naga and J.K. Bana***Department of Agricultural Entomology, Sri Karan Narendra Agriculture University, College of Agriculture, Jobner, Jaipur, Rajasthan, India.***ABSTRACT**

A field experiment on the Seasonal Incidence of Whitefly, *Bemisia tabaci* in Bt cotton was carried out at the Department of Entomology, S.K.N. College of Agriculture, Jobner, Jaipur, Rajasthan, during Kharif 2023 and 2024. The incidence of whitefly commenced in the 34th Standard Meteorological Week (SMW) with initial populations of 2.12 and 0.66 whiteflies per three leaves in 2023 and 2024, respectively. The pest remained active for a prolonged period and attained its peak during the 44th SMW (36.88 whiteflies/3 leaves) in 2023 and the 45th SMW (42.36 whiteflies/3 leaves) in 2024, before declining to low levels by the second week of December. Correlation studies revealed that whitefly population exhibited a significant positive association with maximum temperature ($r = 0.61$ and 0.67) and sunshine hours ($r = 0.45$ and 0.57), while a significant negative association was observed with relative humidity ($r = -0.47$ and -0.58). However, minimum temperature and rainfall showed a non-significant influence. These findings suggest that prevailing temperature, humidity, and sunshine hours play a key role in determining the seasonal incidence and population dynamics of whitefly in Bt cotton under semi-arid conditions of Rajasthan.

Keywords: *Bt cotton; Bemisia tabaci; maximum temperature; weather parameters; whitefly*

Influence of Sodium Potassium Niobate ($\text{Na}_{0.5}\text{K}_{0.5}\text{NbO}_3$) nanoparticle on yield and yield attributes of Sugar Beet (*Beta vulgaris*)**Anita Yadav, Awanish Dubey***Department of soil science, Institute of agricultural Science, Bundelkhand University, Jhansi, Uttar Pradesh, India.***ABSTRACT**

A field experiment was conducted during RABI 2024 at karguanji research farm, department of soil science and agriculture chemistry, Bundelkhand University, Jhansi (Uttar Pradesh). The soil texture of experimental site was loamy sand, with a pH of 8.1, low organic carbon (0.58%), available Nitrogen (208.14 kg/ha), available phosphorus (12.57 kg/ha), available potassium (232.14 kg/ha) and Ec (0.29 d Sm⁻¹). The experiment was laid out in completely randomized design with five treatments to evaluate the performance of sodium potassium niobate nanoparticles on Yield and Yield attributes of sugar beet. The treatments consist moistened with deionized water (0.0ppm, 200ppm, 400ppm, 600ppm and 800ppm). The results revealed that plant height was recorded significantly higher 56.30cm, maximum number of bulb diameter (13.02cm), maximum number of leaf fresh weight (59.21gm), maximum leaf dry weight (6.46gm), maximum bulb fresh weight (130.00 gm), maximum bulb dry weight (11.03gm) were recorded with the treatment of Sodium potassium niobate nanoparticles 200ppm + 400ppm as compared to other treatments.

Keywords: *Influence Nanoparticles; Sodium potassium niobate; Sugar beet; Yield*

Population Dynamics of Whitefly *Bemisia tabaci* in Bt cotton and its correlation with weather parameters**Sheetal Kumawat^{1*}, B.L. Naga¹ and J.K. Bana²**¹*Department of Agricultural Entomology, Sri Karan Narendra Agriculture University, College of Agriculture, Jobner, Jaipur, Rajasthan, India.*²*Department of Agricultural Entomology, Agriculture University Kota, College of Agriculture, Kota, Rajasthan, India.***ABSTRACT**

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Keywords: *Bt cotton; Bemisia tabaci; maximum temperature; weather parameters; whitefly***Abiotic and biotic stress management under climate change in horticulture crops****Shankar Lal Kumawat***Department of Fruit Science (Horticulture), College of Horticulture and forestry Jhalawar Agriculture University, Kota, Rajasthan, India.***ABSTRACT**

With its swift and unpredictable effects, climate change poses a danger to sustainable agriculture and makes it more difficult for farmers and agricultural researchers to adapt to biotic and abiotic stressors. The possible impact of global climate change on plant-pest populations would depend on the interplay of climate variables such as temperature, precipitation, humidity, and other elements including soil moisture, atmospheric CO₂, and tropospheric ozone (O₃). These variables can have direct effects on plants or systemic effects, including changes in the predominance of insect pests, which can lead to differences in horticulture crops production.

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Keywords: *Abiotic and biotic stress; Climate change; Horticulture crops*

Climate-Resilient Agriculture and Sustainable Water Resource Management for Global Food Security**Shivam***Department of Vegetable Science, Agriculture University Jodhpur, Mandore, Rajasthan, India.***ABSTRACT**

Agriculture, food security, and water resources stand at the nexus of global sustainability, with climate change exacerbating challenges of production, access, and equity. The UN projects that global food demand will rise by nearly 60% by 2050, yet resource constraints threaten productivity. Climate-resilient crops and adaptive farming systems are pivotal in mitigating risks from droughts, floods, and shifting rainfall, which already affect over 1.3 billion people worldwide. Water scarcity—projected to impact over 40% of the global population by 2030—necessitates sustainable irrigation, precision farming, and conservation practices. Simultaneously, contamination and overuse of freshwater demand integrated management of land, forests, and biodiversity. Innovations in organic farming, integrated pest and nutrient management, and residue-free food production are driving healthier ecosystems, while advancements in dairy science, aquaculture, sericulture, and allied sectors are enhancing nutritional and livelihood security. ICT-enabled smart agriculture, coupled with indigenous technical knowledge, intellectual property management, and effective transfer of technology, offers transformative opportunities. Post-harvest technologies, food processing, and value addition, alongside agri-marketing, entrepreneurship, and exports, promise increased farmer income and agribusiness growth. Globally, smallholder farmers produce about 80% of food in developing nations, underscoring the need for inclusive policies. Sustainable forestry, hi-tech horticulture, and water-energy-food nexus approaches ensure holistic resource management. Government initiatives and international collaborations in research, extension, and policy frameworks are pivotal in addressing these complex challenges. This conference invites discussion on innovative, science-led strategies that integrate traditional wisdom with cutting-edge technologies to ensure resilient, sustainable, and profitable agricultural systems for future generations.

Keywords: *Food security; contamination; organic farming; Sustainable forestry***Climate Change and Horticulture: Emerging Risks and Resilient Strategies****Gulab Kumawat***Department of Horticulture, Rajasthan Agricultural Research Institute (SKNAU, Jobner) Durgapura, Jaipur, Rajasthan, India.***ABSTRACT**

The impacts of climate change are increasingly evident in horticulture, where crop growth, productivity, and quality are highly dependent on environmental conditions. Rising temperatures, irregular rainfall, frequent droughts, and shifts in pest and disease incidence are creating major challenges for fruit, vegetable, and ornamental production. Although higher atmospheric carbon dioxide can, in some cases, stimulate plant growth, this advantage is often offset by heat stress, water limitations, and declines in nutritional value. To address these issues, protected cultivation systems such as polyhouses, shade structures, and hydroponic setups have emerged as effective options to stabilize production under variable climates. At the same time, approaches like precision irrigation, integrated crop management, and the use of climate-resilient varieties are gaining importance. Advances in biotechnology, nanoscience, and digital agriculture offer further opportunities to minimize risks and support adaptation. Ensuring future sustainability, however, will require region-specific strategies, policy support, and active involvement of growers.

Keywords: *Climate change; horticultural crops; resilience; protected cultivation; sustainable production*

Harnessing Castor Oil-Based Nano-Emulsion as a Sustainable Insecticidal and Growth-Inhibitory Agent Against Diamondback Moth (*Plutella xylostella* L.) in Cabbage
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ABSTRACT

The diamondback moth (*Plutella xylostella* L.) remains one of the most destructive pests of cruciferous crops, causing extensive yield losses worldwide and exhibiting rapid resistance to conventional insecticides. This underscores the urgent need for eco-friendly alternatives. The present study explores the potential of castor oil (*Ricinus communis*)-based nano-emulsion as a sustainable insecticidal and growth-regulatory compound against *P. xylostella* on cabbage. Castor oil, valued for its natural bioactive compounds, was formulated into nano-emulsions to enhance its stability and bioavailability. Laboratory bioassays demonstrated that higher concentrations of the nano-emulsion induced >80% larval mortality. Surviving larvae exhibited significant growth retardation, prolonged developmental duration, and reduced pupation success, confirming its strong growth-inhibitory action. The nano-emulsion system markedly improved the efficacy of castor oil compared to its crude form, highlighting the synergistic role of nanotechnology in botanical pest management. This work provides promising evidence for integrating castor-based nano-formulations into sustainable pest control strategies. Adoption of such eco-friendly technologies may reduce dependence on synthetic insecticides, mitigate resistance development, and support climate-smart agriculture.

Keywords: Castor oil; nano-emulsion; *Plutella xylostella*; botanical insecticide; growth regulation; nanotechnology; sustainable pest management

Changing Climate in Beed District and Its Impacts: A GIS-Based Analytical Study

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EXTENDED SUMMARY**Abstract**

Beed district, located in the drought-prone Marathwada region of Maharashtra, has witnessed significant climate variability over the past two decades (2000–2020). Using GIS tools and satellite imagery, this study identifies clear trends of declining annual rainfall, increasing average temperatures, and land use changes. These shifts have significantly affected agriculture, water availability, public health, and livelihoods. The research combines quantitative meteorological data with spatial analysis to understand the scale and scope of the impacts. It also reviews government schemes and local adaptations to recommend future strategies for building resilience against climate risks

Keywords: Beed District; Climate Change; GIS; Satellite Imagery; Rainfall Decline; Temperature Rise; NDVI; Migration; Agriculture; Maharashtra; Adaptation Strategies; Sustainable Development

Introduction

Climate change is one of the most pressing global challenges of the 21st century, with far-reaching impacts on ecosystems, agriculture, water availability, human health, and socio-economic systems. While the effects of climate change are visible globally, their intensity and manifestation vary regionally, often being more severe in environmentally fragile and economically vulnerable areas. One such region is Beed district, situated in the drought-prone Marathwada region of Maharashtra, India.

Beed's location in the rain shadow zone of the Western Ghats makes it inherently susceptible to low rainfall and frequent droughts. Over the last two decades (2000–2020), Beed has experienced noticeable shifts in climatic parameters, including declining rainfall, rising average temperatures, shrinking water bodies, and changes in cropping patterns. These climatic changes are not isolated occurrences but form part of a broader trend of regional climate variability exacerbated by anthropogenic activities, land degradation, and unsustainable resource exploitation.

The climate crisis in Beed has had severe implications on agricultural productivity, groundwater depletion, food security, public health, and livelihoods. Farmers are facing increased uncertainty in sowing and harvesting seasons due to erratic monsoon behavior. Groundwater tables are declining rapidly, leading to a sharp rise in borewell dependency. Health indicators such as child malnutrition and heatstroke incidents are on the rise. Moreover, the socio-economic impacts are evident in the increased seasonal migration from rural areas to urban centers, as traditional livelihoods fail to sustain the population.

While global climate models offer projections, there is an urgent need for localized climate impact assessments that combine meteorological data with geospatial technologies. In this context, Geographical Information Systems (GIS) and remote sensing tools provide powerful means to analyze land use changes, rainfall trends, vegetation indices (NDVI), and surface temperatures. Such tools can help visualize the changing landscape and inform targeted interventions for mitigation and adaptation. This study aims to conduct a comprehensive analysis of climate change in Beed district, integrating meteorological data and GIS-based evidence. It explores:

The trends in rainfall and temperature over two decades,

Changes in land use and vegetation cover using satellite imagery,

The multi-sectoral impacts of climate change, particularly on agriculture, water, and health,

The effectiveness of existing government schemes and community-level adaptations.

Through this research, we aim to highlight the urgency of climate-responsive planning and sustainable resource management. The findings are expected to contribute to policy formulation, disaster preparedness, and local governance frameworks in drought-prone districts not only in Maharashtra but across semi-arid regions of India.

In a world increasingly threatened by climate volatility, the case of Beed serves as both a warning and a call to action. There is a pressing need to shift from reactive to proactive, data-driven climate adaptation strategies, and this paper attempts to lay the groundwork for such a shift.

Methodology**Data Sources**

Indian Meteorological Department (IMD) rainfall and temperature data

Landsat & Sentinel-2 satellite imagery

NDVI analysis for vegetation cover

Census data for migration and demographic changes

Tools Used:

QGIS

Google Earth Engine

Excel for statistical analysis

Climate Trends in Beed (2000–2020)

Rainfall

Average rainfall has declined from ~850 mm/year to ~690 mm/year.

Monsoon unpredictability has increased, with frequent dry spells.

Temperature

Average annual temperature rose by 1.2°C from 2000 to 2020.

Extreme heat days (above 42°C) increased in frequency and duration.

Land Use Changes

Forest cover reduced by ~6% (as per NDVI maps).

Agricultural land expanded but with more fallow patches due to water stress.

GIS and Satellite Imagery Analysis

NDVI maps show a declining vegetation index across Beed, especially in Patoda, Shirur, and Ashti talukas.

Satellite data from 2000 vs 2020 shows reduction in water bodies and shrinking river widths (e.g., Sindphana river).

Land surface temperature (LST) maps reveal increased urban heat islands in Beed city and surrounding growth centers.

A Review of Case Studies on Carbon Farming and Regenerative Agriculture Technologies

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ABSTRACT

Climate change has heightened the urgency for innovative land management strategies that simultaneously reduce greenhouse gas (GHG) emissions and sustain agricultural productivity. Carbon farming has emerged as a holistic approach, integrating agricultural practices with carbon sequestration to transform farmlands into effective carbon sinks. Since 1990, global anthropogenic GHG emissions have risen by 54%, reaching 59 Gt CO₂-eq in 2019. India now ranks as the third-largest emitter, following China and the U.S., under government-defined emission limits. Agriculture—vital for food security contributes nearly one-third of global GHG emissions, with soil degradation, at 13.7% and livestock, at 11.6% as major sources. Carbon farming provides a sustainable pathway by reducing emissions while increasing carbon storage in soils and vegetation. It is widely recognized as a key strategy for climate change mitigation, soil health improvement, and enhanced farm productivity. Globally, adoption also opens opportunities for farmers in emerging carbon markets, where they earn additional income via carbon credits. These credits, representing the removal or reduction of one metric ton of CO₂ or its equivalent, are generated through practices such as agroforestry, soil carbon sequestration, biochar application, and regenerative farming. When traded, they incentivize farmers financially while helping industries meet regulatory obligations and climate targets. Evidence demonstrates measurable outcomes: agroforestry increases soil organic carbon by 20–30%, conservation tillage retains 0.3–1.0 t C/ha annually, biochar sequesters carbon for centuries, and rotational grazing enhances root biomass. Complementing these, regenerative agriculture technologies, including soil sensors, remote sensing, blockchain-based verification, no-till machinery, and cover crops improve monitoring, resilience, and climate-smart productivity. This review emphasizes carbon farming as a scalable and market-linked solution to achieve carbon neutrality while securing long-term food security and sustainable agricultural growth.

Keywords: Agroforestry, Carbon Credits, Carbon Farming, Regenerative Agriculture, Soil Carbon Sequestration

Thermo-adaptability of Stud Bulls Using Heat Tolerance Indices Under Heterologous Climate
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College of Veterinary and Animal Sciences, Kishanganj, (Bihar Animal Sciences University, Patna) Bihar

ABSTRACT

Present experiment was conducted on 25 stud bulls (5 from each genetic group belonging to Sahiwal, Gir, Jersey cross, Holstein Friesian cross and Murrah buffalo bull) at Frozen Semen Bull Station, Haringhata, Nadia (West Bengal) in two seasons, viz., winter and summer to study their thermos-adaptability under heterologous climate. Rectal temperature, pulse rate and respiration rate of bulls were recorded in forenoon and afternoon and three heat tolerance indices (Iberia heat tolerance indices, Benezara Coefficient of Adaptability and Dairy Search Index) were calculated as per formula. Significant ($P < 0.01$) variations among genetic groups, seasons and genetic groups within a season were observed in all the three methods of thermos-adaptability estimation. Rank of a particular genetic group with respect to heat tolerance capability was not same in all the three methods. During summer season heat tolerance indices showed higher deviation from their respective values of perfect thermos-adaptability as compared to that of winter season. Bulls found to be more adaptable in winter season as compare to summer season.

Keywords: Thermo-adaptability, stud bulls, heat tolerance indices, season

Role of Extension Education in Agricultural Development of Chhattisgarh: A Data-Based Perspective

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ABSTRACT

Extension education has emerged as a vital tool in enhancing agricultural productivity and improving rural livelihoods by transferring scientific knowledge and technologies to farming communities. In Chhattisgarh, where nearly 70% of the population is dependent on agriculture, extension activities play a decisive role in addressing challenges such as low crop yields, traditional farming practices, and limited awareness of improved technologies. As per the Directorate of Economics and Statistics (2023), the state produced about 10.2 million tonnes of food grains, with rice occupying nearly 65% of the gross cropped area. Despite this, productivity remains below the national average due to constraints like inadequate mechanization and poor adoption of climate-resilient practices.

Data from Krishi Vigyan Kendras (KVKs) across the state reveal that farmers who participated in frontline demonstrations recorded 15–22% higher yields compared to non-participating farmers, particularly in rice and pulses. Training programs on integrated nutrient management, pest control, and water-use efficiency have further improved farm income. ICT-based interventions such as Kisan Call Centers, mobile advisories, and farmer producer organizations (FPOs) have also enhanced access to real-time information and market linkages.

The findings suggest that strengthening extension networks, promoting participatory approaches, and integrating digital platforms are crucial for achieving higher productivity and sustainability in Chhattisgarh agriculture. Extension education not only contributes to improved yields but also empowers farmers socially and economically, making it a key driver for rural development in the state.

Keywords: Extension education, Chhattisgarh agriculture, technology adoption, KVKs, farmer training, ICT in agriculture, yield improvement, rural development.

Kinetic Energy Harvesting Using Speed Breakers: A Green Innovation for Sustainable Energy
Kartikey Paliwal^{1*}, Bhavana Singh² and Dharmendra Singh Tomar²¹*School of Education, Sanskriti University, Mathura, India*^{2,3}*School of Basic and Applied Sciences, Sanskriti University, Mathura, India***Purpose**

With the growing global energy demand and the urgent need to mitigate climate change, there is a pressing need to explore sustainable energy alternatives. Piezoelectric materials offer a promising solution by converting mechanical stress into electrical energy. This study focuses on the development and feasibility analysis of Piezoelectric Speed Breakers (PSBs) as a means of harvesting wasted kinetic energy from vehicular motion, especially in densely trafficked areas like highways, toll plazas, and school zones. By aligning with the vision of green technology, the project aims to evaluate PSBs as a dual-purpose innovation for traffic control and renewable energy generation.

Material and Methods

The proposed speed breaker integrates piezoelectric transducers (primarily PZT-based ceramics) within a mechanical structure designed to endure vehicular load. A prototype was constructed and tested under simulated load conditions representing real-world vehicular pressure. Key materials included piezoelectric plates, elastic supports, a rectifier circuit, energy storage modules (supercapacitors), and data acquisition tools. Output voltage and energy efficiency were recorded across varying vehicular weights and speeds. The collected data was compared with theoretical estimations and existing models for renewable road-based harvesting systems.

Results

Initial testing demonstrated that the piezoelectric speed breaker produced an output voltage range between 1.2V to 6.4V depending on vehicle type and frequency of movement. With repeated compression cycles, the energy was successfully stored and utilized to power low-energy street lamps and sensors. The system showed good durability and a conversion efficiency of approximately 20–25% under optimal conditions. The results highlight the real-world applicability of the design in urban planning for smart cities.

Conclusions

This study confirms that Piezoelectric Speed Breakers can serve as an effective renewable energy source in high-traffic environments. By converting wasted mechanical energy into usable electricity, this green innovation supports climate mitigation efforts and offers a sustainable upgrade to conventional infrastructure. The integration of such systems in roads not only promotes energy self-sufficiency but also aligns with global goals of clean, affordable, and innovative energy solutions under SDG 7 and SDG 11.

Keywords: Piezoelectric Effect, Speed Breakers, Renewable Energy, Green Technology, Smart Infrastructure, Sustainable Development Goals

Digital media usage by children and Parental well-being**Prema Patil and Sunita Ilager***Department of Human Development Family Studies, College of Community Science**University of Agriculture Sciences, Dharwad***ABSTRACT**

Digital media refers to electronic content such as images, videos, and information that can be transmitted and accessed through electronic devices like computers and smartphones. The study aimed to assess the digital media usage by children and parental well being in Dharwad, Karnataka. A total of 240 students (120 urban and 120 rural) in 5th, 6th, and 7th grades from both private and government schools were included. The tools used were self-structured questionnaire to measure digital media usage, Parenting stress index – [PSI] by Abidin, (1995) and the socio-economic status scale for determining participants socio-economic status. More than half (56.7%) per cent of children exhibited moderate digital media usage, 32.9 per cent had high usage, and 10.40 percent had low usage of digital media. Smart TVs were the preferred device for majority of children (37.9%), followed by smartphones (27.1%), tablets (19.2%), and computers (15.8%). The purpose of digital media usage was for homework and school-related activities (25.0%), followed by entertainment (22.1%). Gaming was the purpose for 16.3 per cent, while only 10 per cent used digital media for communication. Regarding the time spent on digital media activities, 42.10 per cent spent 1 to 2 hours followed by 3 to 4 hours (26.70%). A smaller percentage spent less than 1 hour (19.60%), and very few children spent more than 4 hours (11.70%) on digital media. Regarding parental stress more than half of the parents were experiencing high parenting stress (63.70 %), followed by normal parenting stress (32.10 %), and only 4.20 per cent of the parents had low parenting stress. There was a significant association(chisquare-14.72*) at 1 per cent level and difference at 5 percent level (F-3.49*) between digital media usage by children and parenting stress of higher primary school children.

Occupational stress and mental well being of bus conductors**Prema Patil and Sunita Jamanal***Department of Human Development and Family Studies College of Community Science**University of Agricultural Sciences, Dharwad***ABSTRACT**

The study on occupational stress and mental well being of bus conductors was conducted in Hubli-Dharwad, Karnataka. The sample comprised of 100 male and 100 female bus conductors. Self structured questionnaire, occupational stress index, mental - health inventory and socio-economic status scales were used. The objectives of the study were to assess the occupational stress and mental health, study the influence of personal and familial factors on occupational stress and mental health and inter-relationship between personal and familial factors with job stress and mental health of conductors. A significant difference in job stress and mental health was observed among conductors belonging to different age groups, experience, distance travelled, type of family, spouse education and spouse occupation among both male and female conductors. A significant association between age, spouse education, spouse occupation with job stress and a significant association between age, spouse occupation with mental health was observed among both male and female conductors. Further a significant difference was also observed in job stress and mental health among male and female conductors. Female conductors had high job stress and poor mental health compared to male conductors.

Prospects of Peach (*Prunus persica* L.) Cultivation in Bihar Under Changing Climatic Conditions
Vikas Chandra¹, A.K. Singh², Pankaj Kumar³, S.K. Verma⁴ and Vaibhav Kumar⁵¹*Department of Horticulture (Fruit & Fruit Tech.), B.A.U., Sabour, Bihar*²*Directorate of Research, B.A.U., Sabour, Bihar*³*Department of MBEG, B.A.U., Sabour, Bihar*⁴*Department of Horticulture (Floriculture & Landscaping), Udai Pratap College, Varanasi, Uttar Pradesh*⁵*Basic Sciences Division, ICAR-Indian Institute of Pulse Research, Kanpur***ABSTRACT**

Peach (*Prunus persica* L.), which has traditionally been cultivated in temperate regions, is now gaining prominence in the agroclimatic zones of Bihar due to the development of several low-chilling cultivars. Climate change, evidenced by rising temperatures, irregular rainfall patterns, and inconsistent chilling hours, presents significant challenges to sustainable peach production in the region. This study assesses the adaptability and performance of selected low-chill peach varieties under the subtropical conditions of Bihar, focusing particularly on their phenological responses, fruit quality, and yield stability in the face of changing climatic trends. The focus is on climate-resilient orchard management practices, including updated planting schedules, protective irrigation methods, and integrated pest and disease management strategies. Peach farming in Bihar has strong potential as a profitable horticultural venture, especially with the right varietal selection and adaptive interventions. This can contribute to crop diversification and improve farmer livelihoods in the face of climate variability.

Keywords: *Prunus persica*, climate change, phenology, crop diversification, quality, Yield.

Effect of different coating material and packaging materials on quality and shelf life of Kinnow (*Citrus nobilis* X *Citrus deliciosa*) fruit**Archana Yadav***Fruit Science, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Naini, Prayagraj.***ABSTRACT**

The present investigation entitled "Effect of different coating material and packaging materials on quality and shelf life of Kinnow (*Citrus nobilis* X *Citrus deliciosa*) fruit." was conducted at Post Harvest Laboratory, Department of horticulture, Naini agriculture college, SHUATS, Prayagraj (U.P.) during the academic year 2022-24. Packaging and coating treatments include T0 (Control or no packaging), T1 (Bee wax coated fruit packed in newspaper), T2 (Bee wax coated fruit packed in brown paper), T3 (Bee wax coated fruit packed in HDPE), T4 (Acacia gum coated fruit packed in newspaper), T5 (Acacia gum coated fruit packed in brown paper), T6 (Acacia gum coated fruit packed in HDPE), T7 (Guar gum coated fruit packed in newspaper), T8 (Guar gum coated fruit packed in brown paper) T9 (Guar gum coated fruit packed in HDPE). The physio-chemical and organoleptic evaluation of the fruits of each treatment was done up to 21 days and all the observations were recorded at every 7 days interval. The PLW (%) and Volume loss (%) were recorded lowest in the fruits packed in T5 during storage which were (3.45%) and (0.74%) respectively. Total soluble solids and total sugar contents had increasing trend during storage period and found highest (11.89) and (10.69) in T5 treatment respectively at 21 days while ascorbic acid and titrable acidity had decreasing trend and mean value was found highest (16.31) and (0.81) in T5 treatment respectively during storage. On the basis of organoleptic evaluation nine point hedonic rating scale, it was concluded that kinnow fruits packed under Acacia gum Coating+ Brown Paper Wrapping scored highest overall acceptability at 21 days of storage, and it can be recommended to farmers for prolonging the storability of the fruits at ambient conditions.

Keywords: Kinnow, Acacia gum, Guar gum, Beewax, Brown paper, Newspaper, HDPE

Impact of Plant Growth Regulators on Flower Crop Growth and Performance

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ABSTRACT

Plant growth regulators (PGRs) are key agents in regulating plant development by modulating hormonal metabolism, distribution and the expression of genetic potential at both the transcriptional and translational levels. These regulators influence a wide range of physiological processes, including growth, differentiation and responses to environmental stimuli. The exogenous application of PGRs is widely practiced by commercial growers of ornamental and flower crops to improve economically valuable traits, such as flower size, color, shelf life and overall plant vigor. The effectiveness of PGRs is influenced by several factors, including the method of application, the plant's ability to absorb and translocate the regulators, and environmental conditions. Proper application techniques are essential for optimizing the benefits of PGRs, minimizing the risk of phytotoxicity, and enhancing productivity. Understanding the variables that affect plant responses to PGRs is crucial for maximizing their efficiency and ensuring sustainable crop management.

Keywords: Plant Growth Regulators (PGRs), hormonal regulation, genetic expression, crop productivity, commercial horticulture.

Impact of Agro-Silvo-Pastoral Systems and Climate Change on Semi-Natural Grasslands and Forest Ecosystems: Insights from the Italian Alps with Applicability to Mediterranean Regions
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ABSTRACT

In biodiversity conservation, water management and maintaining cultural heritage, the mountain semi-natural grasslands in the north-western Italian Alps are playing an important role. Historically, traditional agro-silvo-pastoral systems integrating agriculture, forestry and grazing practices were cultured here to sustainably manage landscapes. However, the shift towards modern monoculture farming has led to biodiversity loss, soil erosion and reduction of ecosystem resilience amidst climate change impact. The aim of the study is to critique the impact of agro-silvo-pastoral management and climate change on these mountain semi-natural grasslands. The main focus is to compare the traditional polyculture systems with contemporary monoculture methods to examine their ecological, economic and social implications, by providing a multidisciplinary approach encompassing ecological assessments, biodiversity indices and ecosystem service valuation. The environmental impacts and benefits will be evaluated by statistical analysis and ecological economics principles. By redesigning resilient agroforestry models aligning ecological principles the study will further explore to contribute

into biodiversity conservation, ecosystem service enhancement and sustainable agroforestry based agroecosystem exploration in mountain regions of North-western Italy. Moreover, the theoretical framework and methodologies are adaptable to Mediterranean regions such as Sardinia, where semi-natural landscapes face similar pressures of climate change, depopulation, wildfire risks, and monoculture expansion. Thus, the research aims to provide transferrable insights for both Alpine and Mediterranean ecosystems. The research results will strive to enlighten policy interventions for promoting agroecological resilience and sustainable land management in the Italian Alps, Sardinia, and other similar mountain ranges and landscapes of Europe under changing climatic conditions.

Keywords: Agro-silvo-pastoral systems; Climate change adaptation; Biodiversity conservation; Ecosystem services; Sustainable land management; Mediterranean and Alpine landscapes

Estimation of Socio-Economic condition and Marketing Constraints of Apple Growers in Shimla District of Himachal Pradesh: An Empirical Study

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ABSTRACT

This study explores the socio-economic profile of apple growers and the marketing constraints faced by producers and intermediaries in Shimla district of Himachal Pradesh. Primary data were collected from 120 farmers and 20 intermediaries in Theog, Mashobra, and Jubbal-Kotkhai blocks. Descriptive analysis and Garrett Ranking were used to assess household characteristics and prioritize key challenges. Findings revealed that a majority (61.67%) of the respondents were marginal farmers with an average landholding of 1.80 hectares, largely devoted to apple orchards. Despite moderate educational attainment and investment in orchard infrastructure, farmers reported major constraints including price fluctuation and middlemen exploitation (Garrett score: 72.51), adverse weather, and lack of technical knowledge. Intermediaries, including commission agents, contractors, wholesalers, and retailers, identified delayed payments, price volatility, and lack of proper storage and infrastructure as key operational challenges.

The study recommends strengthening price stabilization schemes, promoting transparent market practices, improving access to low-interest credit, and supporting Farmer Producer Organizations (FPOs). Enhancing irrigation, storage, and transport infrastructure is also essential for a more efficient and equitable apple value chain.

Keywords: Socio-economic analysis, Constraints, Garrett ranking, marketing, Apple Farming, Shimla, Himachal Pradesh (INDIA).

Genetic Assessment of BC₂F₂ and BC₂F₃ Populations Originating from the Cross between β -Carotene Rich Field Corn (*Zea mays* L.) and Sweet Corn (*Zea mays* var. *saccharata*) for Yield and Sweetness Traits

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ABSTRACT

CAUM66 was identified as a superior landrace, and its improved version, the CAUM66 β^+ inbred line, exhibited both high productivity and elevated β -carotene content. This landrace is widely cultivated and well-accepted by farmers in Manipur, making it a promising parental line for breeding programs. Similarly, DBT-16, a biofortified sweet corn inbred line, proved to be a superior parent in hybrid yield trials due to its high productivity and enhanced sugar content. Therefore, the present study was undertaken to evaluate the genetic variability, heritability, and trait distribution patterns in BC₂F₂ and BC₂F₃ populations developed from a cross between β -carotene-rich field corn (CAUM66 β^+) and biofortified sweet corn (DBT-16). Fourteen agro-morphological traits were evaluated for variability. GCV ranged from 3.99% to 13.49%, while PCV varied from 5.51% to 14.75%, with consistently higher PCV values indicating environmental influence. Heritability estimates (46.83% – 97.38%) and GAM (5.95% – 26.10%) suggested that traits such as cob length, cob girth, tassel length, number of tassel branches, and kernels per row contributed most to variability, highlighting additive genetic effects and strong selection potential. Skewness and kurtosis analysis revealed that number of tassel branches exhibited positive skewness and leptokurtic distribution in BC₂F₂ population, while most traits showed negative skewness and platykurtic curves, indicating polygenic control. In the BC₂F₃ population, similarity with the recurrent parent ranged from 79.12% to 82.88%, while total soluble solids (TSS) content varied between 14% and 18%. Based on these parameters, the best four lines were identified from each BC₂F₃ progeny: CAUM66 β^+ $\times$ DBT16 – 7 – 25 – 5 – 15 – 14 and CAUM66 β^+ $\times$ DBT16 – 3 – 5 – 16 – 29 – 17. These lines represent promising genetic resources for future breeding programs targeting biofortified sweet corn. In this study, the successful introgression of the sweetness allele into field corn resulted in the development of improved lines with strong potential for use in hybrid breeding programs.

Keywords: Field corn; sweet corn; variability; heritability; backcross

Study on Marketing practices of Tomato varieties in Karnataka State: An Economic Impact

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ABSTRACT

India is the second largest producer of fruits and vegetables in the world after China. Poor marketing mechanisms currently limit the growth of horticulture. The significant discrepancy between the prices that farmers receive and what consumers pay is a result of ineffective marketing strategies. Marketing plays an important role in fruits and vegetables due to their perishability in nature. The farmers need to decide in a short span where to sell their produce across different markets to get remunerative price. The study was conducted in the Kolar and Chikkaballapura districts of Karnataka state. By random sampling 30 tomato farmers cultivating both hybrid and desi varieties and 10 intermediaries were selected from each district consisting of totally 80 respondents. The study found that, marketing cost per quintal was more in traditional marketing channel (Hybrid- ₹117.30 and Desi- ₹116.80) than modern marketing channel (Hybrid- ₹44.30 and Desi- ₹40.22). Price spread was more in traditional marketing channels (Hybrid - channel-II – 72.30% and channel-I – 65.29%, Desi – channel-II -73.30% and channel-I – 69.45%) than modern marketing channel (Hybrid – channel-III – 45.00%, Desi – Channel-III – 50.00%). Producer share in consumer rupee found more in modern marketing channel (Hybrid -

58.93% and Desi – 50.39%) than traditional marketing channels I and II in both varieties. Marketing efficiency found more in modern marketing channel (Hybrid- 1.24 and Desi 1.02) than traditional marketing channel (channel-I & II) The highest marketing efficiency channel was found to be Producer to Modern retailer to Consumer. Hence, government policies should promote direct marketing models, processing industries and export policies for tomato marketing.

Keywords: Marketing channel, Marketing cost, Market efficiency, Producer share in consumer rupee

Adapting and Mitigating Climate Change through Innovation

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ABSTRACT

Climate change presents unprecedented challenges, marked by a **global temperature rise** and shifting **climate projections** that affect ecosystems, economies, and human health. **Abiotic and biotic stress management** is critical as changing climates intensify environmental pressures, impacting agriculture and biodiversity. To address these challenges, the adoption of **renewable energy** sources such as **green energy**, **biofuels**, and **waste-to-energy** technologies offers sustainable alternatives to fossil fuels. Additionally, **space applications** like **remote sensing** and **GIS** play an essential role in understanding and monitoring climate impacts, providing insights for effective mitigation strategies. **Green technologies** further support **climate mitigation** by promoting sustainability and reducing emissions. Climate change also affects **pests** and **diseases**, requiring adaptive management strategies in sectors like **horticulture** and **veterinary science**. Understanding **climate system dynamics** and feedbacks is crucial for forecasting future impacts. **Technological advances** in **AI**, **machine learning**, and **drones** are revolutionizing climate research, offering new tools to assess, adapt, and mitigate the effects of environmental stress on ecosystems and human health.

Keywords: GIS, AI and machine learning, Renewable energy, Green technologies.

Sustainable Agriculture and Water Management for Food Security

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ABSTRACT

Agriculture, food security, and water resources are critically interconnected in sustaining global populations. Growing challenges such as climate change, population growth, and water scarcity threaten agricultural productivity and food availability. Climate variability leads to unpredictable rainfall, droughts, and soil degradation, which directly impact crop yields and water supplies. To ensure **food security**, sustainable and climate-resilient agricultural practices are essential, including **efficient irrigation**, **water conservation**, and adoption of **drought-resistant crops**. Water resources face increasing pressure from overuse, pollution, and changing climate patterns. Sustainable water management techniques—such as **precision irrigation**, **rainwater harvesting**, and **wastewater recycling**—are vital for maintaining agricultural output while conserving water. Advances in **technology**, like **precision farming** and **climate-smart agriculture**, are transforming farming methods to enhance productivity and resilience. Integrated approaches involving **agriculture** and **water resource management** are crucial to address the challenges of feeding a growing population amid environmental stresses. Collaborative efforts and innovative solutions are key to achieving sustainable food security and safeguarding vital water resources for future generations.

Keywords: food security, efficient irrigation, water conservation, precision irrigation, climate-smart agriculture.

Exploring Climate Patterns in Karnataka, India: A Comprehensive Examination of Rainfall and Temperature Variability Over Time and Space**Vikas Chowhan , S.B. Goudappa and D M Chandargi***Department of Agricultural Extension Education, UAS Raichur.***ABSTRACT**

Examining the manifestations and effects of climate change is critically dependent on the spatiotemporal analysis of meteorological variables, particularly in areas where agriculture depends on rainfall. The present study analyzes the change in temperature and rainfall using Mann-Kendall and Sen's slope estimator and also identifies the variations in rainfall by using the Rainfall Anomaly Index (RAI). The main purpose of this study is to assess the variation in climatic variables (temperature and rainfall) among four taluks of Karnataka over 42 years (1981–2022), which might help identify strategies that can aid in addressing the consequences of extreme climate events in the future and in formulating appropriate taluk-specific strategies. The trend analysis of the temperature series revealed a significant increasing trend for the minimum temperature for both seasons, whereas the maximum temperature in the Kharif season shows a decreasing trend. However, there is a significant increasing trend in kharif season rainfall and a nonsignificant increasing trend for rabi season rainfall. The RAI value indicates a relatively greater number of dry periods in Gurmitkal taluk in comparison to Chittapur, Sedam and Yadgiri taluks. The findings of the study can be useful in developing plans to manage water resources effectively and reduce the adverse impacts of droughts, mainly in the study area taluks.

Keywords: Agriculture, Drought, Trend, Temperature, Rainfall,**Eco-Thermal Enhancement of *Salix tetrasperma*: Strengthening Wood Properties for Climate Resilience****Sufiya Shabir¹, Dr. Bhupender Dutt², Dr. G.M. Bhat¹,**¹*Department of Silviculture and Agroforestry, Faculty of Forestry, SKUAST-K, Benhama Ganderbal, 191201, J&K, India*²*Department of Forest products and Utilization, College of Forestry, Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan, 173230, H.P, India***ABSTRACT**

The sustainable utilization of wood resources under a changing climate necessitates eco-friendly modification techniques that enhance physical and chemical properties without reliance on synthetic preservatives. Thermal treatment of *Salix tetrasperma* wood has emerged as a promising strategy to improve material performance in response to climate-driven challenges such as elevated decay pressure and fluctuating environmental conditions. In this study, wood samples subjected to thermal modification across a temperature gradient (60–200°C) exhibited significant alterations in their physical and chemical characteristics. Moisture content declined markedly from 192.03% in untreated wood to 140.09% at 200°C, while specific gravity increased from 0.401 to 0.515, reflecting enhanced density and reduced hygroscopicity. Dimensional stability improved, with volumetric shrinkage and swelling decreasing from 7.42% and 8.03% in controls to 3.42% and 3.85% at higher temperatures, demonstrating resilience against climate-induced variations in humidity. Chemically, extractive content, including cold and hot water solubles, increased notably at moderate temperatures, while alcohol-benzene extractives and lignin peaked at 200°C, indicating polymer breakdown and redistribution. Conversely, holocellulose content declined from 79.18% in the control to 70.89% at 200°C, evidencing degradation of cellulose and hemicelluloses under heat. These findings highlight thermal modification

as a sustainable approach to improving wood durability and stability under climate variability, supporting its role in promoting environmentally responsible material use in vulnerable ecosystems.

Keywords: Thermal modification, Climate resilience, Dimensional stability, Chemical composition, *Salix tetrasperma*

Textural Qualities Of Soypaneer Affected By Varying Pressing Pressure And Pressing Time

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ABSTRACT

The experiment was conducted at the department of Agricultural Process Engineering, CAE & T, VNМКV, Parbhani (Maharashtra) to study the effect of varying pressing pressure and pressing time on textural qualities of soypaneer. Soypaneer was prepared using 0.2% citric acid as a coagulant. Four levels of pressing pressure (1, 2, 3, 4 bar) and three levels of pressing time (15, 20, 25 min) were taken and soypaneer samples were prepared. The textural properties (Hardness, Cohesiveness, Springiness, Gumminess, Chewiness and Adhesiveness) of soypaneer samples were evaluated using texture analyzer (TA. XT. Plus Texture Analyzer, Stable Micro System, UK). The study indicated that all the textural properties of soypaneer were found to increase with increase in pressing pressure and pressing time. The pressing pressure of 3 bar and pressing time of 25 min were found to get desired hardness of Soypaneer.

Keywords: Soypaneer, coagulant, hardness etc.

Response of Selective Mechanization Practices For Increase in Productivity of Safflower

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All India Coordinate Research Project on Safflower ,Vasantrao Naik Marathwada Krishi Vidyapeeth Parbhani, Maharashtra, India.

ABSTRACT

A field experiment was conducted at All India co-ordinated Research Project on Safflower, V.N.M.K.V., Parbhani on a clayey soil during Rabi season of 2020 to find out the effect of two factors viz., Selective mechanization plot (SMP) and Farmer practice (FP) with two treatments. Each experimental unit was non replicated. The fertilizer dose of 60:40:00 NPK kg ha⁻¹ was applied at the time of sowing. The field experiment consist of treatment combinations for comprising practices on mechanization and non-mechanization (Farmer Practice) i.e. sowing, spraying and harvesting on soybean-safflower cropping sequence. Experiment was laid out in two different plots each having 1000 m² area without replication one is under mechanization another one non-mechanization i.e. famer practices for sowing , intercultural operations, spraying and harvesting, so that it tested in T-test plot design. The results of the experiments revealed that, use of mechanization practices in soybean-safflower cropping systems recorded significantly higher growth and yield of safflower than farmer practices. The seed yield was observed 18.70% increase under mechanized condition than to farmer's practice and cost of cultivation 20 % less in mechanized condition than farmer practice, having benefit cost ratio 3.24 as compare to 2.22 with farmer practice means increase of 1.02 benefit cost ratio over farmer practice.

Studies on assessment of benefits of the adaptation of weather based Agromet Advisory Bulletin (AAB)**Khobragade A. M, Mane R. B, Gote G. N & Kadam Y. E***Department of Agril. Meteorology, VNMKV, Parbhani***ABSTRACT**

Crop production is a direct output of manageable (agronomic) and unmanageable (weather) inputs. A farmer can cut down losses in crop production due to aberrant weather conditions by following the weather forecast. The India Meteorological Department is providing weather forecast at district and block level. Under the All India Coordinated Research Project on Agrometeorology-National Innovations in Climate Resilient Agriculture, an Agromet Advisory Bulletin (AAB) is prepared by using this forecast for the coming five days and disseminated to farmers. To evaluate the impact of AAB in two selected villages, Italapur and Dampuri (district Parbhani) a survey of 100 farmers was conducted. Amongst the 100 farmers. Study concluded that, Agro Advisory Services (AAS) an effective communication media for transfer of technology regarding climate changes information. Agro Advisory Services (AAS) provides basic, timely and accurately pre-information of different climate and weather conditions of different crops. Agro Advisory Services (AAS) helpful to farmers for increase interest, knowledge, adoption and impact of climate changes on agricultural practices. The crop situation of these farmers was compared with nearby fields having the same crops, where forecast is not adopted in Non AAS farmers field. The data was recorded from both the farmers group particularly on crops expenditure incurred by the farmers from land preparation to harvest at every stage, has been worked out and crop growth and yields were observed regularly. The result observed that those farmers who adopted AAS information and implemented it in their field, found the better crop growth and high yield over the non-adopted AAS farmers. The net income of AAS farmers was about Rs. 60000 to 65000 for soybean and while non AAS farmers about Rs. 42000 respectively. Those farmers have adopted the Agromet Advisories on their day to day operation carried out the additional benefits of 58 to 65% respectively with less expenditure. Hence, AAB can help boost crop productivity as well as help reduce risk and make agriculture an eco-friendly and profitable venture.

Keywords: Agro-met advisory bulletin (AAB), weather forecast, Crop cultivation

Awareness of farmers about agricultural pollution caused by pesticides and fertilizers**Nikita B. Netake , Vidya V. Tayde and Jyoti M. Deshmukh***PG Student & Assistant Professor and Professor : Dept. of Agril. Extension Education, VNMKV, Parbhani***ABSTRACT**

The present study entitled “Awareness of farmers about agricultural pollution caused by pesticides and fertilizers” was conducted in Latur, Renapur and Udgir tehsils of Latur district of Maharashtra State. A sample of 120 farmers was randomly selected from 12 villages from each village 10 farmers were chose from selected villages. Ex post facto research design was followed in the present investigation. As regard with the profile of farmers it was observed that, 60.83 per cent of the farmers had middle age, 48.33 per cent of farmers were educated up to higher secondary school, majority (73.33%) of the farmers had medium size family, majority (74.17%) farmers had medium annual income, 46.66 per cent of farmers had small size of land holding, 66.67 per cent of farmers had medium level of extension contact, majority (70.00%) of farmers had medium sources of information, 67.50 per cent of farmers had medium social participation and 68.33 per cent of the farmers had medium scientific orientation. It was found that, nearly three fourth (73.33%) of the farmers had medium level of awareness about agricultural pollution caused by pesticides, while 14.17 per cent and 12.50 per cent of farmers had high

and low level of awareness about agricultural pollution caused by pesticides, 65.83 per cent of the farmers had medium level of awareness about agricultural pollution caused by fertilizers, while 22.50 per cent and 11.67 per cent of farmers had high and low level of awareness about agricultural pollution caused by fertilizers, 71.67 per cent of the farmers had medium overall awareness about agricultural pollution caused by pesticides and fertilizers, while 15.00 per cent of farmers had high level of awareness and 13.33 per cent of farmers had low level of awareness about agricultural pollution caused by pesticides and fertilizers. The relationship between profile of farmers and awareness about agricultural pollution caused by pesticides and fertilizers, it was observed that, age had positive and significant relationship with awareness, while education, family size, annual income, land holding, extension contact, sources of information, social participation and scientific orientation had positive and highly significant relationship with awareness about agricultural pollution caused by pesticides and fertilizers. It was seen that, co-efficient of determination (R^2) of the independent variables was 0.5202. It means that 52.02 per cent of total variation in awareness about agricultural pollution caused by pesticides and fertilizers was explained by the selected nine independent variables. Variables like extension contact, sources of information, social participation and scientific orientation were major contributor for attaining variation in awareness about agricultural pollution caused by pesticides and fertilizers.

Keywords : Awareness, Pesticides, Fertilizers, Farmers, Pollution

Effect of seed borne mycoflora on seed germination and seedling vigour index of black gram

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Introduction

Black gram (*Vigna mungo* L. Hepper) belonging to family fabaceae or leguminoceae is one of the important pulse crop and it is also called as Udid, Udad, Mash bean and Urd bean. The fungi viz., *Aspergillus flavus*, *Aspergillus niger*, *Alternaria alternata*, *Macrophomina phaseolina*, *Curvularia* spp., *Penicillium* spp., *Cladosporium cladosporioides*, *Fusarium* spp., *Drechslera* spp., *Rhizopus* spp. etc. were reported to be associated with black gram seeds. (Rahaman *et.al.*, 1999, Rathod *et.al.*, 2012). Many fungi have been reported to be seed borne which causes seed discolouration and rotting of seedlings. The infected seeds fail to germinate or seedlings and plants developed in the field from infected seeds may escape early infection but often may be infected at the later stages of the crop growth

Material And Methods

Effect of seed borne mycoflora on seed germination and seedling vigour index

The effect of pathogenic seed borne mycoflora isolated from seeds of black gram seed samples, on seed germination and seedling vigour index was studied by adopting the procedure of Between Paper (rolled towel paper) method as described by ISTA's rules. The root and shoot length (cm) of randomly selected 10 normal seedlings from each towel paper were measured with the help of scale and seedling vigour index was computed by using formula given by (Abdul and Anderson 1973).

Results And Discussion

Seed Germination:

All the isolated seed borne mycoflora significantly reduced the seed germination as compared to control. The lowest seed germination (54.00 %) was noticed in case of seeds inoculated with *Fusarium oxysporum*. Seed germination with the inoculation of *Alternaria alternata*, *Aspergillus niger*, *Aspergillus flavus*, *Curvularia lunata*, *Rhizophus stolonifer* and *Phoma medicagenesis* were 56.00, 60.00, 61.00, 66.00, 72.00 and 75.00 per cent, respectively. The maximum per cent reduction in seed germination over control was observed in seeds inoculated with

F. oxysporum (33.33 %), followed by *A. alternata*, *A. niger*, *A. flavus*, *C. lunata*, *R. stolonifera* and *P. medicagenesis* were 30.86, 25.92, 24.69, 18.51, 11.11 and 7.40 per cent, respectively over control.

Seedling vigour index:

All these seed borne mycoflora significantly reduced the seedling vigour index of blackgram, compared to control. The lowest seedling vigour index (1323.2) was observed with the inoculation of *Fusarium oxysporum*, as against maximum in control (2103.2). It was followed by *Alternaria alternata*, *Aspergillus niger*, *Aspergillus flavus*, *Curvularia lunata*, *Rhizhophus stolonifer* and *Phoma medicagenesis* and were 1382.5, 1504.2, 1560.0, 1694.5, 1782.2 and 1875.00 per cent, respectively.

The maximum reduction in seedling vigour index (37.08 %) was recorded in the seeds inoculated with *Fusarium oxysporum*, followed by *Alternaria alternata*, *Aspergillus niger*, *Aspergillus flavus*, *Curvularia lunata*, *Rhizhophus stolonifer* and *Phoma medicagenesis* were 34.26, 28.48, 25.82, 19.43, 15.26 and 10.85 per cent, respectively over control.

The above results clearly showed that seed borne mycoflora of black gram taken in the study could be able to reduce germination percentage and ultimately seedling vigour index. These results are more or less similar to the finding of Rahman *et al.* (1999), Javaid *et al.* (2005), Kandhare (2014), Santoshi *et al.* (2017), Kandhare (2020), proved that, these seed borne fungi produced mycotoxins that affected adversely the seed germination, shoot and root length of all test pulses. Nanda *et al.* (2020) etc. Supports the findings of the present study.

These seed borne mycoflora affected on the seed germination and seedling vigour index. *Fusarium oxysporum* and *Alternaria alternata* was highest reducing the seed germination (33.33 & 30.86 %) and SVI (37.08 & 34.26 %) respectively.

Table 1: Effect of seed borne mycoflora on seed germination and seedling vigour index of black gram

Sr.No	Seed borne mycoflora	Seed germination(%)	Reduction in seed germination over Control (%)	Seedling Vigour Index	Reduction in Seedling Vigour Index over Control (%)
1	<i>Aspergillus flavus</i>	1.00 (51.34)	24.69	1560.0	25.82
2	<i>Aspergillus niger</i>	60.00 (50.75)	25.92	1504.2	28.48
3	<i>Fusarium oxysporum</i>	54.00 (47.27)	33.33	1323.2	37.08
4	<i>Alternaria alternata</i>	56.00 (48.42)	30.86	1382.5	34.26
5	<i>Curvularia lunata</i>	66.00 (54.31)	18.51	1694.5	19.43
6	<i>Rhizopus stolonifer</i>	72.00 (58.03)	11.11	1782.2	15.26
7	<i>Phoma medicaginis</i>	75.00 (59.97)	7.40	1875.0	10.85
8	Control	81.00 (64.14)	-	2103.2	-
	SE ±	0.56		18.07	
	CD at 1 %	1.67		53.50	
	CV (%)	2.11		2.22	

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Antidiabetic Activity of Extract of *Terminalia chebula* and *Moringa oleifera* in STZ induced Albino rat

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ABSTRACT

Diabetes mellitus is a persistent metabolic disorder that places a substantial health and economic strain on societies. Given the numerous limitations of currently available medications, it is crucial to explore alternative therapeutic options. Medicinal plants utilized in traditional medicine present promising candidates. Therefore, this research was conducted to examine the antidiabetic properties of crude extracts and solvent fractions derived from the seed powder of *Terminalia chebula* and the leaf powder of *Moringa oleifera* in albino rat induced with streptozotocin (STZ). The *in vitro* α -amylase inhibition assay was executed using the chromogenic 3, 5-dinitrosalicylic acid (DNSA) method, while the antihyperglycemic effects were evaluated through three mouse models: streptozotocin-induced diabetic albino rat, normoglycemic albino rat, and those subjected to an oral glucose challenge. Experimental diabetes was induced via a single intraperitoneal injection of streptozotocin at a dosage of 150 mg/kg, with animals exhibiting fasting blood glucose levels (BGL) exceeding 250 mg/dL classified as diabetic. Sitagliptin (50 mg/kg) served as the standard reference drug. Fasting BGL and body weight were utilized to evaluate the antidiabetic efficacy. The results were analyzed using SPSS software, employing one-way ANOVA followed by Tukey's post hoc test, with $p < 0.05$ deemed statistically significant. The crude extracts of *T. chebula* and *M. oleifera* at all administered dose levels (500, 750, and 1000 mg/kg) demonstrated a significant reduction in BGL across all three animal models. Furthermore, the ethyl acetate and aqueous fractions (at 500 mg/kg) significantly ($p < 0.01$) lowered BGL in the streptozotocin-induced diabetic model. The crude extract and various solvent fractions also exhibited a dose-dependent *in vitro* α -amylase inhibitory activity and enhancement of body weight. The crude extract of *T. chebula* and *M. oleifera*, along with its solvent fractions, displayed significant antihyperglycemic activity in STZ-induced diabetic albino rat, hypoglycemic effects, and improved oral glucose tolerance in normal albino rat.

Keywords: diabetes mellitus, streptozotocin, α -amylase, medicinal plant

Medicinal plants used for treating cancer in India: an ethnopharmacological Review**Mukul Bajjal and Manish Kumar***Department of Zoology, Narain College, Shikohabad, UP, India***ABSTRACT**

Cancer is a leading cause of death globally. Although 30% of cancers can be effectively treated if identified in their early stages, the treatment process is complicated by factors such as tumor cell resistance to anticancer medications, adverse effects of therapies, high costs of treatment, and limited access to healthcare services. In Africa, particularly within the East African botanical region, various ethnic communities uphold their traditions and utilize medicinal plants for managing diseases, including cancer. This reviews the ethnobotanical knowledge regarding the application of both wild and cultivated plants as cancer treatment remedies in India, alongside their phytochemical properties and documented anticancer effects. An extensive electronic literature review was conducted using databases such as PubMed, Science Direct, Scopus, Google Scholar, Web of Science, Scientific Electronic Library Online, and the Google search engine, resulting in the identification of 115 plant species from 105 genera across 35 families that have been reported for cancer treatment in India. The types of malignancies addressed by these herbal remedies include squamous cell carcinoma of the gum, prostate, blood, bone, breast, colorectal, colon, esophageal, lung, liver, skin, stomach, throat, and uterine cancers. Most of the identified species have demonstrated anticancer properties, with *Toddalia asiatica*, *Annona muricata*, *Carica papaya*, *Catharanthus roseus*, *Moringa oleifera*, *Ocimum gratissimum*, *Prunus africana*, and *Zanthoxylum paracanthum* being the most extensively researched. Despite the prevalent use of medicinal plants for cancer management in India, further investigation into the bioactivity, safety profiles, responsible anticancer compounds, and clinical studies is essential to clarify the mechanisms of action of these compounds and to validate the potential of lesser-studied species.

Transforming Indian Higher Education: An Analysis of Online Teaching Adoption and Effectiveness**Rajan Kumar Verma¹, Akhilesh Kumar², Rakesh Kumar³***Deptt. of Chemistry Narain College Shikohabad, U.P., India,¹**Deptt. of Physics, Narain College Shikohabad, U.P., India^{2,3}***ABSTRACT**

The emergence of online teaching has significantly transformed the landscape of higher education in India. Accelerated by the COVID-19 pandemic, digital learning platforms have become integral to academic delivery, prompting institutions to rethink traditional pedagogical methods. This research examines the effects and uses of online education in Indian higher education, with an emphasis on accessibility, instructional quality, technological infrastructure, and student participation. It also examines challenges such as the digital divide, lack of training among educators, and limitations in practical learning. Despite these obstacles, online teaching has opened new avenues for flexible, self-paced education. It has facilitated the integration of multimedia resources, MOOCs, virtual laboratories, and AI-driven tools to enhance learning experiences. The study concludes that while online education cannot entirely replace face-to-face instruction, it offers a complementary model that, if implemented effectively, can broaden the reach and improve the quality of higher-education in India.

Keywords: Online teaching, Higher education, Digital learning platforms, Multimedia resources, Virtual labs, AI-driven tools

Innovations in English language learning and teaching**Alka Singh***Department of English, A.K. P.G. College, Hapur, Uttar Pradesh, India***ABSTRACT**

Innovations in English language learning and teaching have redefined traditional educational practices, making language acquisition more interactive, learner-centered and technology-driven. The integration of digital tools, such as language learning apps, virtual classrooms, AI-powered chatbot, and gamified content, has enhanced students' engagement and motivation. Modern pedagogical approaches, such as flipped classrooms, blended learning, and task-based language teaching, encourage active participation and real-world application of language skills. Additionally, data analytics and adaptive learning platforms enable personalized instruction based on learners' progress and needs. These innovations have not only improved accessibility and flexibility but have also addressed diverse learning styles and linguistic backgrounds. However, effective implementation requires continuous teacher training and infrastructural support. This paper highlights how such innovations are shaping the future of English language education and fostering better communication skills and global competence among learners.

Keywords: Blended learning, chatbot, innovations, Language learning apps, Virtual Classrooms.

Characterization of Fertility Restorer Genes and Wide Compatibility Locus in Rice Genotypes using SSR Markers**Sanjay Kumar Singh***Department of Genetics and Plant Breeding, JNKVV, Jabalpur, Madhya Pradesh, India (482 004)***ABSTRACT**

The present experiment aims to characterise the rice genotypes for the identification of fertility restorer genes and a wide compatibility locus. A total of 32 genotypes were grown under Rice Improvement Project, Department of Plant Breeding and Genetics, College of Agriculture, J.N.K.V.V, Jabalpur, Madhya Pradesh, India for the fertility restoration in rice (*Oryza sativa* L.) is traditionally complex and time-consuming, as it involves test crosses with a set of cytoplasmic male sterile (CMS) lines and evaluation of F₁ for pollen and spikelet fertility. The use of molecular markers linked with fertility-restoring *Rf* genes can improve the selection efficiency, save time and avoid the complications associated with phenotype-based screening. Among The rice genotype 15 were strong fertility restorers, 3 partial restorers, 5 weak maintainers and 4 were maintainers with no seed setting and rest 5 genotypes were partial maintainers. Thirteen SSR markers reported to be linked to *Rf* genes were analysed on the rice population included for this study. Out of thirteen markers, 7 were polymorphic while six were monomorphic. Molecular study revealed that RMS-SF-21 reported specific for male sterility maintainer alleles in the genotypes WGL-32100, JGL-3828 and RPHR- 612. Marker s5-inDel is specific marker produced three alleles (*indica*, *japonica* and wide-compatible) on NPT 13-01, RYT 3378, JR (SF) 21 and PRR 812 genotypes for development of high fertility as well as high yielding rice hybrids. Genotypes CBSN 168 and Jagtiyal Sanalu found to be partial restoration and providing single banding pattern 420 bp while, genotypes Kranti, JRSF-21, RYT-3378 and PRR-312 provided dominance of japonica neutral alleles and all these genotypes are normal fertile and good adapted to the environment. Overall study revealed that the s5-inDel marker is valuable, cost-effective tool in heterosis breeding to identify the allelic status at S5 locus in rice genotypes.

Optimization of Mepiquat chloride sprays for retarding growth in closer spacing of *Bt* cotton**A.D. Pandagale, K. S. Baig, B.V. Bhede, V.N. Chinchane, S.N. Devkule, P.K. Dhoke***Cotton Research Station, Nanded (VNMKV, Parbhani, Maharashtra)***ABSTRACT**

Cotton being important cash crop in central India in general and Maharashtra in particular, plays vital role in national economy. Closer planting is proved to be an option to improve productivity especially under rainfed condition where its productivity is quite low. Growth retardation is necessary under closer spacing for which growth retardant, Mepiquat chloride was found beneficial. Hence a trial on management of plant canopy by using Mepiquat chloride was conducted at Cotton Research Station, Nanded, Maharashtra under AIRCP on Cotton project to optimize number of Mepiquat chloride sprays for cotton. *Bt* cotton hybrid NCS 2778 BG II was sown at 90 x 30 cm spacing (37,037 plants / ha) in 26 SMW. One, two and three sprays of Mepiquat chloride were tested with and without detopping and were compared with control and detopping only. Thus, eight treatments were evaluated in three replications and were analyzed in randomized block design.

Plant height was significantly reduced in Mepiquat chloride spray and detopping treatments over control. The plant height in detopping treatment was reduced by 38.67 per cent whereas one, two and three sprays of Mepiquat chloride (T_3) has reduced plant height by 12.83 per cent, 21.76 per cent and 24.69 per cent, respectively. Detopping and Mepiquat chloride sprays has reduced number fruiting branches *i.e.* sympodia plant⁻¹ over control. Number of nodes plant⁻¹, height to node ratio and number of bolls per plant were significantly reduced with application of Mepiquat chloride as well as detopping. However, boll weight was significantly increased with two sprays of Mepiquat chloride (5.11 g to 5.39 g) over control (4.48 g). Similarly, two sprays of Mepiquat chloride + detopping recorded highest yield plant⁻¹. Significantly highest seed cotton yield was recorded in treatment two sprays of Mepiquat chloride (at square initiation and 15 days after first spray) + detopping (2650 kg ha⁻¹).

The gross monetary returns were significantly higher from two sprays of Mepiquat chloride + detopping (Rs. 1,81,998/- ha⁻¹). The net monetary returns were statistically on par in all the treatments. Control, detopping as well as one spray of Mepiquat chloride treatments were most remunerative with highest BCR (1.57).

Evaluation of Wound-Healing Potential of Chinese Guava (*Psidium cattleianum*) stem bark Extract in Excision Wound Model in Rats**¹Varsha Raj*, Manish Kumar²**¹(Faculty of Pharmacy) Kharvel Subharti College of Pharmacy, Swami Vivekanand University, Meerut, 250005 UP, India²Department of Zoology, Narain College, Shikohabad, UP, India**Background**

Wound healing is a complex biological process involving inflammation, tissue proliferation, collagen synthesis, and remodeling. Herbal plants rich in antioxidants and antimicrobial compounds have gained attention for promoting faster and safer wound repair. Chinese guava (*Psidium cattleianum*), also called strawberry guava, contains flavonoids, tannins, and phenolic compounds with proven antimicrobial and antioxidant activities, suggesting potential wound-healing benefits. However, limited studies have evaluated its activity in animal models.

Methods

Stem bark of *P. cattleianum* were collected, authenticated, shade-dried and extracted using hydroalcoholic solvent (70% ethanol). Wistar albino rats (n = 18) were divided into three groups: control (ointment base), standard (povidone-iodine 5%), and test (5% *P. cattleianum* extract ointment). Full-thickness excision wounds (~300 mm²) were created under anesthesia. Treatments were applied

topically once daily for 14 days. Wound contraction (%), epithelialization period, tensile strength, hydroxyproline content, and histopathological changes were recorded.

Results

Topical application of *P. cattleianum* extract significantly accelerated wound closure compared to the control group ($p < 0.05$). Complete epithelialization occurred earlier in the treated group, with higher hydroxyproline levels and tensile strength. Histology confirmed increased fibroblast proliferation, collagen deposition, and reduced inflammatory cells.

Conclusions

The hydroalcoholic stem bark extract of *P. cattleianum* demonstrated promising wound-healing activity in rats, likely due to its antioxidant and antimicrobial phytoconstituents. Further studies on isolated bioactive compounds and clinical evaluation are warranted to develop standardized herbal formulations for wound management.

Study of Aerosol Optical Depth (AOD) over the Nainital Town, using AERONET data

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ABSTRACT

Global warming is largely driven by the excessive emission of greenhouse gases such as carbon dioxide, methane, and CFCs, resulting from both human and natural activities. In Nainital town, there has been a noticeable increase in the concentration of dry carbon, haze, fog, and clouds. This study focuses on analyzing Aerosol Optical Depth (AOD), along with the Ångström exponent and precipitable water content, over Nainital in the Kumaun Himalaya using AERONET data from 2008 to 2011. The highest AOD values during the monsoon season were observed in 2008 (0.515), 2009 (0.395), and 2010 (0.390). The Ångström exponent peaked in the post-monsoon season of 2010 at 1.546, while the lowest value (1.131) was recorded in 2009. An inverse relationship was identified between the Ångström exponent and AOD, with a correlation coefficient of -0.59. Additionally, precipitable water showed a similar seasonal pattern to AOD and exhibited a strong positive correlation ($r = 0.79$) with it.

Effectiveness of the Success of Sanitation and Hygiene Programs in Reducing Waterborne Diseases in Rural Bangladesh

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ABSTRACT

The goal of this study is to assess the usefulness of sanitation and hygiene measures in minimizing waterborne illnesses in rural Bangladesh. Despite the measures put in place by the government and the non- governmental organizations, waterborne infections are still widespread in these places, and they harm the health of the people and their quality of life. This research combines both quantitative health data and qualitative interviews from the local population to assess the impact of various sanitation and hygiene treatments. The research is centered on five rural districts of Bangladesh, including Chandpur, Gaibandha, Cox's Bazar, Khulna, and Mymensingh, which are physically and socio-economically

diverse from each other. These are the sorts of data that have been gathered; for example, the incidence of waterborne illnesses, availability of sanitary services, and hygiene. The quantitative part comprises the use of statistical data from health records and surveys to determine the link between the increase in sanitation and illness rates. The qualitative element comprises focus group sessions with the community members and program staff to understand the hygiene program delivery and its effect. Research data reveals that whilst there has been development in certain locations, there is still some distance to go, particularly in areas that are prone to floods, overpopulation, and lack of proper infrastructure. The research also suggests that there is a need for the creation of solutions that are specific to the local setting and that community engagement should be continuous. The results of the research are important for policymakers and public health practitioners to appreciate the relevance of the multi-faceted strategy to sanitation and hygiene that encompasses both the hardware and software components. This research will assist in discovering the gap between the execution of the program and the demands of the community in order to build better strategies for the prevention of water related illnesses in rural Bangladesh.

Keywords: Sanitation programs, hygiene interventions, waterborne diseases, rural Bangladesh, public health, mixed-methods research, disease reduction.

Exploring the Cross Disciplinary Implications of Mathematics in Cyber Security and Metal Additive Manufacturing

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ABSTRACT

This paper investigates the integration and application of advanced mathematical models in the fields of cybersecurity and metal additive manufacturing (AM). Utilizing a comprehensive analysis of Finite Element Models (FEM) and Computational Fluid Dynamics (CFD), we evaluate their effectiveness in enhancing security protocols and improving manufacturing processes. Our study reveals that FEM significantly outperforms CFD and other statistical models in both domains, offering superior accuracy, efficiency, and reliability. The methodology involves a detailed comparative analysis and real-world implementation of these models, supported by quantitative metrics and qualitative observations. In cybersecurity, FEM models are employed to identify and mitigate threats, demonstrating marked improvements in intrusion detection and system resilience. In metal AM, FEM aids in optimizing process parameters and predicting material behaviors, leading to enhanced product quality and reduced manufacturing defects. Case studies illustrate the practical impact of these models, highlighting their applicability in various scenarios. We discuss the implications of our findings, both practical and theoretical, and address limitations such as computational demands and generalizability. Future research directions are proposed to further refine these models and expand their application scope. This study underscores the transformative potential of integrating sophisticated mathematical models in tackling contemporary challenges in cybersecurity and manufacturing, paving the way for innovative solutions and improved practices in these critical areas.

Keywords: Mathematical models, cybersecurity, metal additive manufacturing, finite element models, computational fluid dynamics, intrusion detection, process optimization.

Histopathological Response and Effect of Elevated Conditions on *Fusarium oxysporum* inciting wilt of pea (*Pisum sativum* L.)**Kota Chakrapani, Bireswar Siha, Lokesh Kumar Mishra, W. Tamapkleima Chanu, Tusi Chakma, Bijeeta Thangjam, Sumitra P, Sumita K, Nitya Shree, Rifana Ajam, LNK Singh***College of Agriculture, Central Agricultural University, Imphal***ABSTRACT**

(*Pisum sativum* L.) a grain legume belongs to the family of Fabaceae. It is one of the oldest and mostly widely domesticated crops across the temperate regions of the globe. Pea possessing the nature of self pollinating holds a chromosomal number of $2n=14$ with a haploid genome size of 4.5 Gbp. the production pea is prone to various biotic and abiotic stress among which *Fusarium* wilt induced by *Fusarium oxysporum* f. sp. *pisi* (Fop) is an important disease and a major constraint in pea production incurring losses to the growers. The major barricade faced by 21st century is climate change, which is imposing serious threats on agriculture produce. The research was undertaken to study the survival and infectivity nature of the pathogen. At different temperatures and pH and Nitrogen doses, it is observed that isolates showed maximum growth and sporulation at temperature 25°C and pH 5. Combination effect of Nitrogen doses and different pH exhibited that growth was increased when the pH levels were moving towards neutral levels at all the increasing doses of the Nitrogen source. The similar trend of results was observed in case of micro and macro conidial formation at each combination of different temperatures and different pH, and different Nitrogen doses. Maximal micro and macro conidial formation was observed at 25°C and pH 7, but there was high variation among conidial formation by supplementing the higher doses of nitrogen. In a similar study of combination effects was performed to analyse the fresh and dry weights of all the six isolates of Fop, which resulted in significant variation among the isolates with change in temperature, pH and Nitrogen doses. Field Screening studies of sixty pea genotypes against 3 Fop was performed for during 2021-22 and 2022-23, the reaction results infectivity variation of 3 Fop isolates. Ambiguity was found among the infectivity nature of isolates against sixty pea genotypes screened. Based on the screening results, the genotypes were categorized to resistance, (FPT20-31, Makhyatmubi), tolerant (CAU-FP7), moderately tolerant (Makuchabi), susceptible (FPT 20-17) and highly susceptible (FPT-20-25 and FPT 20-35). Based on the screening results 8 genotypes were taken for histopathological studies. The tissues of each genotype were fixed according to the standard protocols. Later the tissues were hand sectioned and stained with TBO and Fast green : Safranin stains to observe the changes in the Fop inoculated plants. The observations on histopathological studies were taken after 7th and 14th day of inoculation. Significant changes on categorized hosts were observed. Formation of papillae, Lignification of wall cells, accumulation of phenols, accumulation of carbohydrates, unknown substances was revealed by different stains used and observations were analyzed that the tolerant genotypes CAU-FP7, Makuchabi have shown more defence structures when compared to susceptible genotypes, FPT-20-25 and FPT 20-35.

Keywords: Wilt, *Fusarium oxysporum* (Fop) isolates, Climate change, Temperature, pH and Nitrogen dose, Screening, Histopathology

Pesticide Hazards and their Management**¹Richa Gupta, ²C.P.N Gautam, ³Brajrajsharan Tiwari, ⁴Pradeep Kumar and ¹Preeti Yadav**¹*Department of Entomology, Chandra Shekhar Azad University of Agriculture & Technology, Kanpur-208002, India*²*Krishi Vigyan Kendra, Balrampur, Acharya Narendra Dev University of Agriculture and Technology Kumarganj, Ayodhya-224229, India*³*Department of Agriculture Entomology, Banda University of Agriculture & Technology (BUAT), Banda, Uttar Pradesh (210 001), India*⁴*Department of Entomology, Maharana Pratap University of Agriculture and Technology, Udaipur-313001 (Raj.), India***ABSTRACT**

Pesticides are essential in modern agriculture because they protect crops from pests while also increasing in crop production. The indiscriminate use of pesticides on the other hand causes considerable risks to the environment human health and non-target organisms. This abstract gives an overview of the major dangers coincided with pesticide use and investigates alternative risk-mitigation options. Pesticide dangers include contamination of the environment, contamination of water and the development of pesticide-resistant bugs. Exposure to contaminated food, inhalation, or skin contact during application pose health concerns to humans. Concerns about biodiversity loss and ecosystem disruption are also raised by the influence on beneficial insects, birds, and aquatic life. Effective pesticide management solutions employ integrated pest management (IPM), which emphasises a holistic approach that integrates biological, cultural, and chemical control measures. Precision application technologies like drones and sensor-based systems help to reduce misuse and reduce environmental effects. Regulatory structures and instructional programmes are critical components in encouraging farmers to use pesticides responsibly.

Keywords: Pesticides, hazards, environment, contamination.

Genetic variability, heritability and genetic advance studies in sesame (*Sesamum indicum* L.)**SB Mitkari, MP Wankhade, SB Ghuge, JD Deshmukh and MG Patil***Department of Genetics and Plant Breeding, VNMKV Parbhani***ABSTRACT**

The current study was conducted on 30 genotypes, including one local check, at the AICRP Experimental Farm on Safflower at Vasantao Naik Marathwada Krishi Vidyapeeth, Parbhani (Maharashtra) during the *summer* of 2022–2023. Three replications of a randomized block design were used to conduct the current experiment. There were notable differences for every character, according to the analysis of variance. The degree of variability in the experiment material was also shown by the genotypic and phenotypic coefficient of variation (GCV and PCV). For the majority of the traits in the current analysis, a large range of variability was noted. Characteristics such as plant height, number of seeds per capsule, seed output per plant, days to 50% flowering, number of capsules per plant, and 1000 seed weight had a larger mean variance range. For each plant, a substantial genetic progress (20.55%) along with high heritability (80.02%) was seen in the seed yield. For the traits of plant height, number of branches per plant, number of capsules per plant, and seed output, the percent mean of all the genotypes under investigation has demonstrated high heritability along with high genetic advance.

Keywords: Variability, heritability, genetic advance, GCV, PCV

Development of Balanced Plant-Based Protein Combinations for Nutritional Support to Mitigate Protein Energy Malnutrition**Mk Maqbool Qutub, Aashika S, and Dr. Shubha Banerjee***Indira Gandhi Krishi Vishwavidyalaya, Raipur, C.G.***ABSTRACT**

The current study pertains to the assessment of qualitative parameters of a few plant protein isolate combinations selected based on their amino acid profile and digestibility, which can potentially substitute or complement complete proteins from animal sources and can be used to fortify traditional foods. The analysis comparing the purity percentage of the isolated proteins showed that the Rice Protein Isolate (RPI) had the highest level of purity, measuring at 78.54% and the maximum protein isolate was obtained from Soybean (20g/100g). Sensory evaluation of PI showed that RPI exhibited a white colour, while RaPI displayed a brown colour. The solubility of RPI, RaPI, and SPI was found to be highest at pH values below, respectively. PDCAAS values for PIs combination shows high for RPI+CPI and RPI+PPI+CPI. The protein profiling conducted using SDS-PAGE indicated the presence of distinct protein fractions in the protein isolates, as demonstrated by prominent bands ranging from 10KDa to 30KDa. The analysis of protein fractions revealed that RaPI had high levels of albumin and prolamine. These combinations of Protein Isolates derived from cereals and pulses hold promising potential as an alternative for a complete protein diet in rural where protein intake is often lower than the recommended levels.

Keywords: Plant protein, Protein isolates, Protein Solubility, Protein Digestibility, and Protein fractionation

Analysis of direct and indirect effect of yield contributing traits in sesame (*Sesamum indicum* L.)**SB Mitkari, MP Wankhade, SB Ghuge, JD Deshmukh and MG Patil***Department of Genetics and Plant Breeding, VNMKV Parbhani***ABSTRACT**

The current study was conducted in the *summer* of 2022–2023 at the Experimental Farm of AICRP on Safflower, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani (Maharashtra), to examine the direct and indirect effects of yield contributing features in 30 genotypes of sesame. Three replications of a randomized block design were used to conduct the current experiment. The trait capsule length had the greatest significant and positive direct effect on seed yield per plant, according to this path analysis of 30 genotypes studied in sesame. At the genotypic level, this was followed by 1000 seed weight, the number of seeds per capsule, plant height, the number of capsules per plant, and the number of branches per plant. The trait 1000 seed weight had the most positive direct effect on seed yield per plant at the phenotypic level, according to the results of path analysis in 30 genotypes of sesame. This was followed by the number of seeds per capsule, plant height, capsule length, and number of capsules per plant.

Keywords: Path analysis, direct effect, indirect effect, sesame, significant

Rhizospheric PGPR: Improving Plant Growth and Stress ResilienceSatyendra Kumar Jha¹ & Swati Thakur²¹Department of S.M.T. School of agriculture Sciences, Sandip University, Sijoul, Madhubani, Bihar-847235²R. K. College, Madhubani, L.N.M.U., Darbhanga, Bihar-847211**ABSTRACT**

Beneficial microorganisms known as plant growth-promoting rhizobacteria (PGPR) proliferate in the rhizosphere and have a favorable impact on the growth, development, and abiotic stress tolerance of plants. The plant growth-promoting (PGP) characteristics of PGPR isolates from wheat rhizosphere, such as the synthesis of indole-3-acetic acid (IAA), phosphate solubilization, ACC deaminase activity, and antagonistic effects on phytopathogens, were examined in the current investigation. 16S rRNA gene sequencing was used to determine which isolate was the most promising. To evaluate the impact of inoculated PGPR on wheat growth under saline stress, a controlled pot trial was carried out. Relative water content, chlorophyll content, and biomass of roots and shoots were significantly improved, according to the results. Among the isolates, *Bacillus velezensis* (W1) significantly increased shoot biomass and water content under salt stress, showing a high potential for stress mitigation. The study offers a straightforward but effective method for incorporating PGPR into sustainable agriculture, particularly in settings that are prone to stress.

Keywords: Plant-microbe interaction, PGPR, Rhizosphere, Salinity stress, Biofertilizer, IAA, ACC deaminase, Sustainable agriculture.

Materials and Methods**Collection of Rhizospheric Soil Samples:**

Samples of rhizosphere soil were taken from soil that was growing in the field. Using sterile instruments, samples were collected 5–15 cm below the surface and brought to the lab in sterile containers for additional examination.

Isolation of Rhizobacteria:

Bacteria were isolated from rhizospheric soil using pour plate and serial dilution procedures. Nutrient Agar (NA) and King's B medium were plated with aliquots (0.1 mL) of diluted suspensions, and they were then incubated for 24 to 48 hours at 28 ± 2 °C. Colonies with unique morphologies were chosen, purified through repeated streaking, and kept at 4°C on slants.

Screening of Plant Growth-Promoting (PGP) Traits

The PGP tests listed below were performed on each isolate:

Production of IAA: The isolates were cultured for 72 hours in Luria-Bertani broth that had been enhanced with L-tryptophan (0.5 mg/mL). Salkowski's reagent was added to the culture supernatant, and absorbance at 530 nm was measured. The standard IAA curve was used to calculate the concentration.

Phosphate Solubilization: Pikovskaya's agar was used for qualitative testing. Following five to seven days of incubation at 28°C, the solubilization zones surrounding the colonies were measured.

ACC Deaminase Activity: The only nitrogen source for the isolates' growth was 3 mM ACC in minimum media. As markers of enzyme activity, growth on ACC medium and the production of α -ketobutyrate were employed.

Antifungal Activity: The dual culture assay was used to test for antagonistic effects against common phytopathogens, such as *Rhizoctonia spp.* and *Fusarium spp.* After five to seven days of incubation, the percentage of mycelial growth inhibition was computed.

Molecular Identification of the Promising strain: A commercial bacterial DNA extraction kit was used to extract genomic DNA from the chosen strain. Using the universal primers 27F and 1492R, the 16S

rRNA gene was amplified and sequenced. NCBI BLAST was used to evaluate the sequence in order to identify it taxonomically.

Assay for Plant Growth (Laboratory Pot Trial): A model plant species' surface-sterilized seeds were used in a germination and growth test on sterilized soil. Seeds were infected with a suspension of the chosen PGPR (10^8 CFU/mL) or left uninoculated (control). Soil soaking and seed soaking were the methods used for inoculation. The plants were cultivated under controlled conditions, with a 16:8-hour light-dark cycle and a temperature between 25 and 28°C. Shoot length, dry biomass, chlorophyll content, and relative water content (RWC) were among the parameters that were measured after 30 days.

Results and Discussion

From samples of rhizospheric soil, 15 bacterial isolates with different morphologies were identified. Multiple plant growth-promoting (PGP) features were the first things that were searched for in these isolates. One isolate, known as W1, continuously demonstrated superior traits among others.

PGP Traits of W1

Indole-3-acetic acid (IAA) Production: In a medium supplemented with tryptophan, isolate W1 generated 45.2 ± 1.6 µg/mL of IAA. It is well recognized that this auxin-like phytohormone promotes lateral root growth and root elongation, which improves nutrient uptake (Glick, 2014; Vurukonda et al., 2016).

Phosphate Solubilization: W1 demonstrated its capacity to transform insoluble phosphate into forms that are accessible by forming an 18 mm clear solubilization halo on Pikovskaya's agar. In soils lacking phosphorus, this characteristic may be essential (Lugtenberg and Kamilova, 2009).

ACC Deaminase Activity: Based on the production of α -ketobutyrate, the isolate showed a notable level of ACC deaminase activity. When plants are under stress, this enzyme reduces their ethylene levels, which encourages root growth and stress tolerance (Glick, 2014; Mishra et al., 2021).

Antifungal action: W1 demonstrated possible biocontrol action by 65.3% inhibiting *Fusarium oxysporum* mycelial development in dual culture experiments. *Bacillus* species have shown comparable antagonistic action against a variety of phytopathogens (Santoyo et al., 2016).

Molecular Identification: Isolate W1 shares 99.2% similarity with *Bacillus velezensis*, according to 16S rRNA gene sequencing and BLAST analysis. The PGP characteristics and biocontrol potential of this species have been extensively studied (Zhang et al., 2020; Compant et al., 2019).

Pot Experiment under Salinity Stress:

Wheat seedlings were subjected to 100 mM NaCl in a pot experiment to assess W1's stress-reduction capabilities. Among the experimental groups were:

T1: Uninoculated control (no stress)

T2: Uninoculated + 100 mM NaCl

T3: Inoculated with W1 + 100 mM NaCl

After 30 days of growth:

Shoot Length: T3 plants showed 28% higher shoot length compared to T2.

Root Biomass: Increased by 32% in T3 over T2.

Chlorophyll Content (SPAD value): 18% higher in T3, indicating improved photosynthetic efficiency.

Relative Water Content (RWC): T3 had 35% higher RWC compared to T2, suggesting better water retention.

These findings clearly show that *Bacillus velezensis* W1 improves growth even under salt stress conditions by regulating physiological parameters. Similar results have been reported for *Bacillus* spp., which modulate plant hormonal balance, improve nutrient uptake, and activate systemic tolerance mechanisms under stress (Timmusk et al., 2017; Khan et al., 2020).

Results and Discussion

W1, one of the 15 isolates, had the greatest IAA (45 µg/mL), phosphate solubilization zone (18 mm), and significant ACC deaminase activity. W1 also reduced Fusarium growth by 65%. *Bacillus velezensis* was validated through molecular identification. In the pot trial, inoculated plants with salinity had 35% more shoot biomass and 28% higher relative water content than uninoculated controls. These findings are consistent with previous studies on *Bacillus* strains that improve stress tolerance (Zhang et al., 2020).

Conclusion

This study successfully isolated and characterized rhizospheric bacteria that produce IAA, solubilize phosphate, degrade ACC, and inhibit phytopathogens. *Bacillus velezensis*, the most promising isolate, greatly improved plant growth and physiological parameters under stress in a controlled setting. These findings support the potential of PGPR as an environmentally benign biofertilizer and biocontrol agent. Their use can reduce reliance on chemical inputs while also improving crop tolerance to abiotic and biotic stress.

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Effect of Organic Nutrients on Biochemical Quality of Onion in North Bihar

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ABSTRACT

A field experiment was conducted during the *rabi* season (November–April) at the Agriculture Research Farm, Sandip University, Madhubani, Bihar, to evaluate the impact of organic nutrient management on the biochemical quality parameters of onion (*Allium cepa* L.) bulbs. The experiment, laid out in a Randomized Block Design (RBD) with four treatments—farmyard manure (FYM) @ 25 t ha⁻¹, vermicompost @ 5 t ha⁻¹, poultry manure @ 3 t ha⁻¹, and control—was replicated thrice. The onion variety ‘Agrifound Light Red’ was transplanted at 15 × 10 cm spacing, with organic inputs incorporated two weeks prior. Biochemical quality traits, including total soluble solids (TSS), pungency (pyruvic acid content), and flavonoid content, were measured using standard protocols. Poultry manure recorded

the highest TSS (14.8 °Brix) and pungency (8.2 $\mu\text{mol g}^{-1}$ FW), while vermicompost significantly enhanced flavonoid content (38.4 mg QE/100 g FW). All organic treatments improved bulb size uniformity, colour, and skin thickness compared to control. The results highlight that organic nutrient management not only enhances biochemical quality but also improves soil health and sustainability. Poultry manure is most effective for improving TSS and pungency, whereas vermicompost is superior for boosting antioxidant-related flavonoids. These findings support integrating organic manures into onion production systems in North Bihar.

Keywords: Onion (*Allium cepa* L.), Organic nutrient management, Biochemical quality, North Bihar

Introduction

Onion (*Allium cepa* L.) is one of the most important commercial vegetable crops grown and consumed worldwide, valued for its distinct flavour, pungency, and health-promoting properties. It belongs to the family Amaryllidaceae and is cultivated mainly for its bulbs, which are consumed fresh, cooked, or processed into dehydrated products, powders, and pickles. Onions are rich in carbohydrates, vitamins, minerals, flavonoids, and sulfur-containing compounds, contributing to their nutritional and medicinal value.

India ranks among the largest onion producers globally, with major growing states including Maharashtra, Madhya Pradesh, Karnataka, Gujarat, and Bihar. In North Bihar, onion is an important rabi crop, contributing significantly to farmers' income and regional vegetable supply.

Biochemical quality traits such as total soluble solids (TSS), pungency (pyruvic acid content), and flavonoid content are key factors determining market price, consumer preference, storage quality, and processing suitability. These traits are influenced by genotype, environment, and nutrient management. With growing awareness of environmental safety and consumer demand for residue-free vegetables, organic nutrient management has gained importance. The use of farmyard manure, vermicompost, and poultry manure improves soil health, nutrient availability, and crop quality. Investigating their influence on onion quality under North Bihar conditions is vital for sustainable production.

Materials and Methods

Experimental Site:

The field experiment was conducted during the rabi season (October–March) at the Agriculture Research Farm, Sandip University, Madhubani, Bihar (26°20'N latitude, 86°5'E longitude, altitude ~53 m above mean sea level). The experimental site had sandy loam soil, slightly acidic in reaction (pH 6.2), with low organic carbon content (0.45%), low available nitrogen (210 kg ha⁻¹), medium phosphorus (14.8 kg ha⁻¹), and medium potassium (186 kg ha⁻¹). The trial was laid out in a Randomized Block Design (RBD) with four treatments and three replications. The treatments comprised T₁: farmyard manure (FYM) @ 25 t ha⁻¹, T₂: vermicompost @ 5 t ha⁻¹, T₃: poultry manure @ 3 t ha⁻¹, and T₄: control (no manure). The onion variety 'Agrifound Light Red' was selected for the study. Nursery sowing was carried out on 10 October, and seedlings were transplanted on 15 November at a spacing of 15 × 10 cm. Organic nutrient sources were incorporated into the soil two weeks prior to transplanting. Weed management was performed manually, and no synthetic fertilizers or pesticides were applied during the crop cycle. For eco-friendly pest management, neem oil sprays were used to minimize pest incidence without compromising organic integrity.

Data Collection

Biochemical quality parameters of onion bulbs were recorded at harvest from randomly selected marketable bulbs in each treatment plot.

Total Soluble Solids (TSS): TSS was measured using a handheld digital refractometer and expressed in °Brix. Fresh onion bulbs were finely chopped, and juice was extracted by gently pressing through a clean muslin cloth. A few drops of the filtrate were placed on the refractometer prism, and readings were taken directly. The instrument was calibrated with distilled water before each measurement session.

to ensure accuracy. Three readings per sample were recorded, and the average value was used for analysis.

Pungency: Pungency was assessed by estimating the pyruvic acid content following the method of Schwimmer and Weston (1961). In this method, fresh bulb tissue (5 g) was homogenized with 25 mL of distilled water and filtered through Whatman No. 1 filter paper. An aliquot of the filtrate was reacted with 2,4-dinitrophenylhydrazine (DNPH) reagent under acidic conditions, and the mixture was incubated at 37°C for 10 minutes. The reaction was stopped by adding sodium hydroxide, resulting in a reddish-brown color. The absorbance was measured at 420 nm using a UV–Vis spectrophotometer, and pyruvic acid concentration was expressed in $\mu\text{mol g}^{-1}$ fresh weight (FW).

Flavonoid Content: Flavonoid content was quantified spectrophotometrically using the aluminium chloride colorimetric method. Fresh bulb tissue (2 g) was homogenized in 80% ethanol and centrifuged at 5000 rpm for 10 minutes. To 1 mL of the extract, 0.3 mL of 5% sodium nitrite was added, followed by 0.3 mL of 10% aluminium chloride after 5 minutes. After an additional 6 minutes, 2 mL of 1 M sodium hydroxide was added, and the final volume was adjusted to 10 mL with distilled water. The absorbance was measured at 510 nm using a UV–Vis spectrophotometer. Results were expressed as mg quercetin equivalents (QE) per 100 g fresh weight.

Results

Total Soluble Solids (TSS):

TSS was measured using a handheld digital refractometer and expressed in °Brix. Fresh onion bulbs were finely chopped, and juice was extracted by gently pressing through a clean muslin cloth. A few drops of the filtrate were placed on the refractometer prism, and readings were taken directly. The instrument was calibrated with distilled water before each measurement session to ensure accuracy. Three readings per sample were recorded, and the average value was used for analysis. Significant variation was observed among treatments. Poultry manure (T_3) produced the highest TSS (14.8 °Brix), followed by vermicompost (T_2) with 14.1 °Brix. FYM (T_1) recorded 13.6 °Brix, while the control had the lowest (12.4 °Brix).

Pungency (Pyruvic Acid Content):

The highest pungency value was recorded in poultry manure treatment ($8.2 \mu\text{mol g}^{-1}$ FW), indicating stronger flavour intensity desirable in market onions. Vermicompost and FYM showed moderate values (7.6 and $7.3 \mu\text{mol g}^{-1}$ FW respectively), while control recorded only $6.5 \mu\text{mol g}^{-1}$ FW.

Flavonoid

Content:

Vermicompost (T_2) significantly enhanced flavonoid content ($38.4 \text{ mg QE/100 g FW}$), followed by poultry manure (35.2 mg) and FYM (34.6 mg). The control showed the lowest (30.1 mg).

Conclusion

Organic nutrient management substantially improved biochemical quality traits of onion bulbs in North Bihar conditions. Poultry manure application was most effective in enhancing TSS and pungency, while vermicompost significantly boosted flavonoid content, indicating its potential role in improving antioxidant capacity. Farmyard manure also improved quality over the control, though to a lesser extent. These findings support the integration of organic nutrient sources in onion cultivation to produce high-quality, nutrient-rich bulbs while improving soil health and reducing dependence on synthetic fertilizers. For commercial growers in North Bihar, adopting poultry manure or vermicompost can improve both market value and long-term sustainability of onion farming.

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Assessment of Carbendazim Residue in Pesticide-Treated Apple

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ABSTRACT

Carbendazim, a systemic benzimidazole fungicide, is widely applied in apple production to control post-harvest fungal diseases such as blue mold (*Penicillium expansum*) and gray mold (*Botrytis cinerea*). This study aimed to quantify and evaluate the dissipation pattern of carbendazim residues in *Malus domestica* cv. Red Delicious apples subjected to post-harvest treatments. Apples free from prior pesticide exposure were treated with carbendazim at recommended (0.1%) and double (0.2%) concentrations, alongside untreated controls. Treated fruits were stored under ambient (20 ± 2 °C) and cold (2 ± 1 °C) conditions, with sampling on days 0, 3, 7, 14, 21, and 28. Residues were extracted using the QuEChERS method and quantified via LCMS. The method yielded recoveries of 85–95% and a limit of quantification of 0.01 mg kg⁻¹. Initial residues were proportional to application rate, averaging 0.62 mg kg⁻¹ for recommended and 1.28 mg kg⁻¹ for double doses. Dissipation followed first-order kinetics, with half-lives of 5.2 days (ambient) and 8.6 days (cold storage). Recommended-dose residues fell below the Codex MRL (2 mg kg⁻¹) by day 21, while double-dose treatments required 28 days. Storage temperature significantly influenced degradation, with slower dissipation in refrigerated conditions. These findings emphasize adherence to recommended application rates and pre-consumption intervals to ensure compliance with international residue standards, particularly for export markets.

Keywords: carbendazim, apple, pesticide residue, dissipation kinetics, LCMS, post-harvest treatment

Introduction

Carbendazim, a systemic benzimidazole fungicide, is extensively used in apple cultivation for the management of post-harvest diseases such as blue mold (*Penicillium expansum*) and gray mold (*Botrytis cinerea*). While it offers effective disease control, the persistence of residues on apple surfaces raises significant concerns related to consumer health, compliance with maximum residue limits (MRLs), and market acceptability, especially in export-oriented supply chains. Understanding the dissipation behavior of carbendazim under different storage conditions is crucial for establishing safe pre-consumption intervals and ensuring food safety.

Materials and Methods

Freshly harvested *Red Delicious* apples without prior fungicide exposure were sourced from a local orchard. Fruits were divided into three groups:

T1: Carbendazim at recommended concentration (0.1%)

T2: Carbendazim at double the recommended concentration (0.2%)

T3: Untreated control

Post-treatment, apples were stored under two conditions:

Ambient storage (20 ± 2 °C)

Cold storage (2 ± 1 °C)

Sampling was carried out at 0, 3, 7, 14, 21, and 28 days after treatment. Residue extraction was performed using the QuEChERS method, and quantification was done via Liquid Chromatography–Mass Spectrometry (LCMS) method. The analytical method was validated, yielding 85–95% recovery with a limit of quantification (LOQ) of 0.01 mg kg⁻¹. Data were statistically analyzed using two-way ANOVA to determine the influence of concentration and storage conditions on dissipation rates.

Results

Initial residue levels were directly proportional to application rates, with mean values of 0.62 mg kg⁻¹ (T1) and 1.28 mg kg⁻¹ (T2). Dissipation followed first-order kinetics, with half-life values of:

Ambient storage: 5.2 days

Cold storage: 8.6 days

By day 21, carbendazim residues in T1 had declined below the Codex MRL of 2 mg kg⁻¹, whereas T2 required at least 28 days to meet compliance. Storage temperature significantly affected dissipation rates, with slower degradation observed under cold conditions. The untreated control showed no detectable carbendazim residues throughout the study.

Conclusion

The study highlights the need to adhere strictly to recommended carbendazim concentrations and observe suitable pre-consumption intervals to ensure compliance with MRLs and safeguard consumer health. Slower dissipation under cold storage indicates that residue persistence may extend beyond expected intervals in refrigerated supply chains. These findings provide a scientific basis for improving post-harvest handling protocols in domestic and export apple markets, balancing effective disease management with minimal pesticide residue risk.

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Smart Lighting in Horticulture: Tailoring Light Spectrum for Enhanced Vegetable Cultivation

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ABSTRACT

Light is a fundamental environmental factor influencing vegetable crop growth, extending beyond its role as an energy source to act as a signal regulating multiple physiological processes. Recent advances have revealed the profound effects of specific light wavelengths on plant morphogenesis, photosynthesis, acclimatization, and stress responses.

This research explores the role of light spectrum management through artificial lighting (e.g., LEDs) and photoselective shade nets in optimizing vegetable production. Different wavelengths affect key developmental stages—red and far-red light influence seed germination and flowering via phytochromes (Pr-Pfr), while blue and UV-A light, perceived by cryptochromes and phototropins, control stem elongation, stomatal opening, and leaf expansion (Casal, 2013; Wang et al., 2020). Specific light treatments have shown measurable agronomic benefits. Red LEDs improve anthocyanin in cabbage and phenolics in lettuce, increase tomato yield, and enhance lutein and chlorophyll in kale.

Blue LEDs combined with red and green increase photosynthesis and stomatal density in cherry tomato (Hernández & Kubota, 2016), while blue LEDs with High-Pressure Sodium (HPS) lamps boost biomass in tomato and cucumber. Green LEDs promote leaf area and dry weight in cucumber, and UV-B (280–315 nm) suppresses powdery mildew in cucumber.

Photos-elective shade nets, such as red nets, modify incident light spectra and improve microclimate, reduce water loss, and enhance yield and quality. Red nets have been associated with increased yield in crops like fenugreek, garlic, and coriander (Shahak et al., 2008). Light spectrum manipulation thus emerges as a sustainable, non-chemical tool for enhancing growth, pest resistance, and nutritional quality in vegetables. Understanding the interaction of light quality with plant photoreceptors is crucial for designing efficient lighting systems and shade materials in nurseries and protected cultivation. Further research will aid in the development of cost-effective, spectrum-optimized lighting technologies tailored to specific vegetable crops.

Keywords: Light spectrum, Phytochrome, Cryptochrome, Shade nets, Photosynthesis, Photomorphogenesis.

Socio-economic and Environmental Performance of Agroforestry based Farming System Practices in Mid-hill Nepal

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ABSTRACT

In Nepal's rural farming systems, agroforestry greatly improves livelihoods and food security. The study, conducted in Kalinchowk Rural Municipality, Dolakha district, used PRA tools such as surveys, key informant interviews, focus groups, observations, and report reviews. Parameters included socio-economic status (demographics, income, livelihood, food sufficiency), environmental changes (drought, rainfall, weather patterns), climate change awareness and impact, climatic status (temperature, precipitation), and agroforestry's economic and environmental contributions. The evaluation tools used were the Likert scale, Climate Data Collection Tools (Weather Stations and Sensors) taken from the Dept. of Meteorology and Hydrology, economic valuation tools, and case studies. Data was analyzed using thematic and statistical methods with Excel and SPSS. Most respondents were Brahmin and Chettri, followed by Janajatis and disadvantaged groups. Agriculture was the main occupation, but food sufficiency was low; only 27.9% produced enough food for a year, and 25.7% for less than six months. Most had low to medium livelihood status. About 62.5% were unaware of climate change, though many noticed changes in weather and precipitation. Climatic conditions fluctuated significantly. Major agroforestry systems included agri-horti-silviculture, home gardens, and silvi-pastoral setups, with agri-horti-silviculture—integrating fruits like oranges and avocados with fodder trees and crops—being the most effective. Agroforestry significantly improved economic status (annual income of Rs. 39,000) contributed to the capital of farmers, health, and livelihoods, and improved environmental conditions through soil fertility, windbreaks, and greenery. Challenges included erratic rainfall, insect infestations, market issues, human-monkey conflicts, and limited knowledge. Women and disadvantaged groups faced some discrimination. Recommendations include better seedlings, training, and market support to enhance agroforestry's socio-economic and environmental impact.

Keywords: Agroforestry systems, Livelihood, Environmental performance, Socio-economic performance

Integrative Health Through Desert Medicinal: Bridging Ethnobotany And Therapeutic Science
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Introduction

Desert ecosystems, often perceived as barren and hostile, are rich in ethnobotanical knowledge and medicinal plant biodiversity that have long served as a lifeline for traditional health care (Aati et al., 2019). The motivation behind this review is to acknowledge and confirm the under-explored natural resources, particularly as global interest in plant-based therapeutics and sustainable healthcare grows. Desert plants, shaped by evolutionary pressures such as aridity and temperature, produce specific bioactive compounds with potential pharmaceutical applications (Aeri & Mishra, 2019). The knowledge of traditional healers has been passed down through generations, and their understanding of the healing characteristics of these plants continues to communities today (Ayyad, 2003). As more research is conducted on these plants, their potential for modern medicine is being identified, and the importance of these valuable resources is being recognized (AKBAR et al., 2018). The integration of ethnobotany with biomedical science in desert areas reveals the full potential of arid-zone desert medicinal plants (Awadh Ali et al., 2017). Bioactive compounds, including flavonoids, alkaloids, terpenoids, and saponins, are found in desert plants, which have evolved compounds under extreme environmental conditions, and may serve as promising leads for drug discovery (Al Mohaya & Elassal, 2020). Traditional knowledge preserved by indigenous desert communities offers invaluable views into the therapeutic utilisation of these plants (Al-Fatimi, 2024). Ethnobotanical practices, when scientifically validated through biomedical tools like phytochemical screening, molecular docking, in vitro assays, and clinical studies, can bridge the gap between traditional healing systems and modern medicine (Ayyad, 2003). Antibiotic resistance and chronic illnesses.

Materials and Methods

This review synthesizes findings from several scientific and ethnobotanical literature, comprehensive phytochemical screenings and *in silico* molecular docking studies (Bhosale & Banerjee, 2019). Desert regions, including the Thar, Sahara, and Sonoran ecosystems, are highlighted for their various species such as *Lepidium draba*, *Anastatica hierochuntica* L, *Aizoon canariense* L, and *Blepharis ciliaris* (L.) B.L. Burtt. Ethnobotanical knowledge of medicinal desert plants and their traditional use in the healthcare system (Amri & Shanfari, 2024). To identify and compile the phytochemical and pharmacological properties of key desert medicinal plants based on existing scientific literature. To evaluate the therapeutic relevance of botanicals using biomedical approaches, including phytochemical analysis, in silico studies. To emphasise the importance of desert biodiversity conservation by showcasing the medicinal potential of arid-region flora. This review encompasses a multidisciplinary exploration of medicinal plants from desert ecosystems such as those in the Thar, Sahara, Sonoran, and Arabian deserts—focusing on their traditional usage, bioactive constituents, and pharmacological potential (Bhat & Malik, 2022). It bridges ethnobotany with biomedical validation methods, including phytochemical screening, molecular docking, and therapeutic modelling—reviewing the sociopractices, which have been successful in traditional knowledge drug discovery (Arteaga et al., 2005).

Results

This review highlights the huge medicinal potential of desert plants, rooted in rich ethnobotanical knowledge and progressively validated through modern scientific approaches (Al-Woraf, 2020). Key visions include the value of community-based conservation, phytochemical and in silico findings, and the urgent need for sustainable cultivation practices to protect biodiversity while raising local

livelihoods (Alshammari & Sharawy, 2010). Desert ecosystems' environments are closely tied to their metabolic profiles. Synthesizing bioactive phytochemical compounds that contribute to their medicinal properties. Ethnobotanical surveys across global desert ecosystems report extensive plant usage for curing diseases, such as infections, diabetes, inflammation, and skin diseases. These surveys serve as a basis for guiding pharmacological validation (Al-Harrasi et al., 2021).

Table 1: Some examples of medicinal plants found in desert environments.

Plant Name	Synonym	Genus	Habitat	Part Used	Disease	References
Blepharis ciliaris (L.) B.L. Burtt	Acanthus pectinatus Willd. ex Nees Blepharis persica (Burm.f.) Kuntze Ruellia ciliaris L. Ruellia persica Burm.f.	Blepharis juss.	Iran Oman Pakistan Sand Plain	Leaf Root Seed	Diuretic Asthma INFLAMATIONS Skin wound Tooth ache Lung disease Renal diseases Cough Sores	https://www.sciencedirect.com/science/article/pii/S2352914819302667
Aizoon canariense L	Aizoon procumbens Crantz Aizoon spathulatum Eckl. & Zeyh. Veslingia cauliflora Moench Veslingia	Aizoon L	Salty hot desert area Non-salty hot desert area	Seed	Gastrointestinal ailments colon carcinoma Liver carcinomas Breast carcinomas Cytotoxic	https://www.sciencedirect.com/science/article/abs/pii/S0022519308000647
Anastatica hierochuntica L	Kaff Maryam (common name)		Arid regions of Saudi Arabia Egypt Jordan Iraq UAE Iran Israel Kuwait North Africa	Leaf bud Stem Root	Asthma Gastrointestinal disorders Depression High blood pressure Indigestion Headache Cold Fever Malaria Epilepsy	https://www.sciencedirect.com/science/article/pii/S2352914819302667

Phytochemicals are naturally occurring compounds that play crucial roles in plant defence and human health. The most common classes found in desert plants include: Desert plants synthesize

a rich array of secondary metabolites such as alkaloids, flavonoids, terpenoids, and phenolics that enable survival under extreme aridity and contribute to their therapeutic utility.

Table 2: Docking studies of desert-derived compounds against therapeutic targets

Plant Name	Types of Phytochemicals	Phytochemicals	Disease	Target Protein	References
Blepharis ciliaris (L.) B.L. Burtt	Flavonoid Glycoside Phenolic acid derivative Alkaloid Steroid Triterpenoid Fatty acid derivative	Apigenin Apigenin 7-O-glucoside Apigenin-7-O-(6"-E-p-coumaroyl)- β -D-glucopyranoside Apigenin 7-(3"-acetyl-6"-E-pcoumaroyl)-glucopyranoside Naringenin-7-O-(6"-E-pcoumaroyl)- β -D-glucopyranoside Naringenin-7-O-(3"-acetyl-6"-E-pcoumaroyl)- β -D-glucopyranoside	Diuretic Asthma INFLAMMATIONS Skin wound Tooth ache Lung disease Renal	Asthma SRC- SYK ADRB2 MAPK1 and MAPK3 CREBBP Protein Kinase C SRC IL4-receptor	https://www.sciencedirect.com/science/article/pii/S2352914819302667
Aizoon canariense L	Tannin Flavonoid Alkaloid	Behenic acid Tricosylic acid Quercetin Lauric acid Stearidonic acid	Gastrointestinal ailments colon carcinoma Liver carcinoma Breast carcinoma Cytotoxic	Breast carcinoma cyclin D1 protein Bcl-2 protein p53 protein ABCG2, ATP-binding cas	https://www.sciencedirect.com/science/article/abs/pii/S002519308000647

Anastatica hierochuntica L	Phenol Volatile oil Glucosinolate Sterol Triterpene Tannin Flavonoid Polyphenol	(-)-lariciresinol kaempferol luteolin rutin b-sitosterol-3-O-b-D-glucopyranoside (-)-dehydrodiconiferyl alcohol (-)-balanophonin evofolin luteolin-6-C-hexosyl-8-C-pentoside luteolin-6-C-pentosyl-8-C-hexoside O-glucoside)	Asthma Gastrointestinal disorders Depression High blood pressure Indigestion Headache Cold Fever	Asthma SRC- SYK ADRB2 MAPK1 and MAPK3 CREBBP Protein Kinase C SRC IL4-receptor PDE4D GNB2L1 STAT1	https://www.sciencedirect.com/science/article/pii/S2352914819302667

Through an in silico approach, we screened phytochemical compounds derived from the desert medicinal plant *Anastatica hierochuntica* L. for drug-likeness and their binding affinities with two target proteins, beta-2 adrenergic receptor ADRB2. The beta-2 adrenergic receptor ADRB2 plays an important role in regulating airway tone & inflammation. It also plays a crucial role in molecular mechanisms that improve effective asthma treatments. The IL4-receptor plays a crucial role in immune responses in asthma, as exemplified by dupilumab, which blocks IL-4 signalling and provides relief for patients with severe asthma. Findings indicate that desert medicinal plants are rich in flavonoids, terpenoids, alkaloids, and saponin phytochemical compounds with proven anti-inflammatory, antimicrobial, and anticancer properties. This study analyses the anti-asthma potential of phytochemicals derived from the desert medicinal herb *Anastatica hierochuntica* L., commonly known as Kaff Maryam (Mary's hand), True Rose Jericho. It is located in the dry regions of Saudi Arabia, the UAE, Iran, Israel, Kuwait, Egypt, Jordan, Iraq and North Africa.

Molecular docking

A post-docking investigation was carried out to study the molecular interactions between the top ten phytochemicals compounds PubChem CIDs 8640, 66962, 332427, 5280445, 5280450, and 5280675 exhibited binding affinities of -3.0, -4.7, -1.8, -3.6, -13.1, and -3.4 kcal/mol, respectively and formed significant interactions within the binding site of the target protein beta-2 adrenergic receptor ADRB2 (PDB ID:3NYA). Various intra-molecular interactions are shown by the docking investigation, as shown in Figure 1 and Table 3. Docking analysis discovered that the ten bioactive compounds exhibited a high affinity for the binding pocket of the beta-2 adrenergic receptor ADRB2 (PDB ID:3NYA) protein, particularly in the area where Albuterol binds. The results showed that certain compounds were able to form stable complexes by hydrogen bonding and hydrophobic interaction to key residues in the binding pocket.

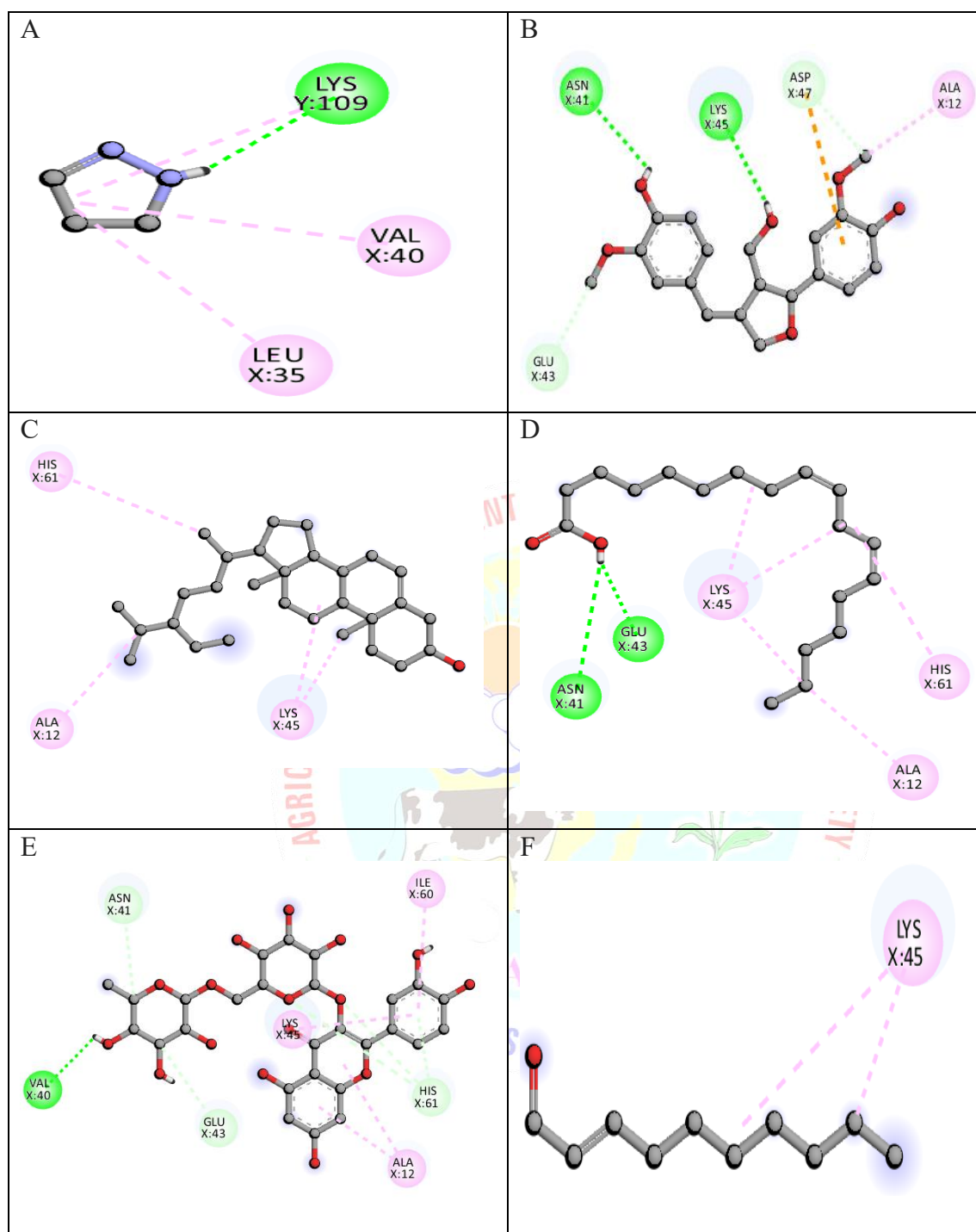


Figure 1: Top ten docked complexes of target protein 3nya and their near intra-molecular interactions. The bio-active phytochemical compounds are displayed in balls and sticks, and the interacting binding sites are shown in the form of sticks. The green dashes stand for hydrogen bonds, and the pink dashes stand for hydrophobic interactions. A)8640, B)66962, C)332427, D)5280445, E)5280450, and F)5280675.

Table 3. Intra-molecular interactions defined by the bio-active phytochemical compound with 3nya

Pubchem id	binding affinity (-kcal/mol)	Interacting group	Intramolecular interactions	Distance

66962	-4.7	ALA 12	Alkyl	3.95
		LYS 45	Hydrogen bond	2.27
		ASN 41	Hydrogen bond	2.62
		GLU 43	Carbon-Hydrogen bond	3.48
		ASP 47	Pi-anion	3.43
5280450	-13.1	VAL 40	Hydrogen bond	2.55
		ASN 41	Carbon-Hydrogen bond	3.16
		GLU 43	Carbon-Hydrogen bond	2.17
		LYS 45	Pi-Alkyl	4.64
		ILE 60	Pi-Alkyl	5.01
		ALA 12	Pi-Alkyl	4.39
		HIS 61	Pi- donor hydrogen	3.17
8640	-3.0	LYS 109	Hydrogen bond	2.08
		VAL 40	Alkyl	4.99
		LEU 35	Alkyl	4.81
332427	-1.8	LYS 45	Alkyl	3.81
		HIS 61	Pi-Alkyl	5.17
		ALA 12	Alkyl	3.99
		ILE 60	Alkyl	4.88
5281675	-3.4	LYS 45	Alkyl	4.59
5280445	-3.6	ASN 41	Hydrogen bond	2.87
		GLU 43	Hydrogen bond	1.96
		HIS 61	Pi-Alkyl	5.43
		ALA 12	Alkyl	3.77
		LYS 45	Alkyl	4.61

Conclusion

A. hierochuntica has long been used in traditional medicine for its therapeutic advantages due to the integral impression in its medicinal benefits. Among its reputed advantages, such as antioxidant, hypoglycaemic, anti-asthmatic & hepato-protective actions, the more deliberate use of different types of **A. hierochuntica** extracts has been noted. The Top bioactive phytochemical compounds were analysed for interactions with protein targets PDB ID: 3NYA and the docking scores indicated excellent interactions with both protein targets. In silico pharma-cophore models were used to predict potential, revealing that a broad range of related therapeutic possibilities were discovered. The integration of traditional desert ethnomedicine with modern pharmacological science shows a promising pathway for novel drug discovery, biodiversity conservation and community-based healthcare. Desert medicinal plants mean not only pharmacological assets but also essential constituents of spirited, sustainable healthcare strategies.

Keywords: Desert medicinal plants, ethnobotany, drug discovery, phytochemicals, *in silico* docking, sustainable healthcare, traditional medicine, biodiversity conservation.

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Phenotypic characterization of rice germplasm lines to mitigate climate vulnerability**Mohan Kumar N. V., Imran Khan H. S., Ningraj Dalwai, Nandini C., Shivleela and Shilpa P Chowti***KSNUAHS Shivamogga***ABSTRACT**

The present investigation was carried out to know the maturity duration variability in the landrace/germplasm lines present in the Kodagu district of Karnataka. Collected 24 landraces from Ponnampet Taluka farmers and 78 from Agricultural and Horticultural Research station (AHRS) Ponnampet. A total of 104 landraces/germplasm lines including checks Tunga, KPR 1, IR 64 and Inton were evaluated with Augmented design during *Kharif* 2024 and 2025 for mainly for maturity duration and as well as recorded yield and yield attributing traits. These lines were again classified in to three groups based on maturity duration *ie.*, 21 lines as short duration which matures between 120 to 135 days after sowing, 69 lines as medium duration which takes approximately 135 to 145 days for maturity and 14 lines as long duration which takes more 145 days attain maturity. For plant height these lines recorded 53cm to 111cm, showed 4 to 11 range of productive tillers per plant and observed 661.88 to 4393.94 kg/ha range of grain yield variation. Hence these lines are having a huge diversity further investigation on disease reactions, insect resistance and quality parameters will provide basic genetic materials for rice improvement. Maturity duration is one of the very important component to mitigate climate vulnerability because rain fall is not uniform throughout the season as well as it is not maintaining specific pattern now a day's therefore identification of short, medium and long duration varies are need of our. Because monsoon starts early means farmer can choose long duration variety, if monsoon starts very late then short duration varieties can be recommended.

Keywords: Germplasm, Long duration, Medium duration, Short duration and Monsoon**Building Predictive Model by Using Data Mining Techniques****Kumar Sanjeev¹ and Suneeta Paswan²**¹ MBAC, Agwanpur, Saharsa², KVK, Agwanpur, Saharsa**ABSTRACT**

In the era of big data, predictive modeling has emerged as a powerful tool for extracting meaningful insights and making data-driven decisions. This study focuses on building predictive models using data mining techniques to analyze historical data and forecast future outcomes. Data mining involves the systematic discovery of patterns and relationships in large datasets through statistical, machine learning, and computational techniques. The objective of this work is to construct an accurate and reliable predictive model by applying methods such as classification, regression, and clustering. Key steps include data preprocessing, feature selection, model training, evaluation, and validation. Various algorithms, including decision trees, random forests, support vector machines, and neural networks, are evaluated for their performance using metrics such as accuracy, precision, recall, and F1-score. The results demonstrate how appropriate data mining approaches can enhance predictive accuracy and support strategic decision-making in fields such as finance, healthcare, marketing, and more. This development underlines the importance of clean data, robust algorithms, and effective evaluation methods in the successful deployment of predictive models.

Keywords: Data mining, Model, Feature Selection

Estimation of Socio-Economic condition and Marketing Constraints of Apple Growers in Shimla District of Himachal Pradesh : An Empirical Study .**Richa Rana¹, Shiva Pujan Singh², Md.Minnatullah,³ Ms. Vaishnavi Thaksen Abhang,⁴**¹Department of Agricultural Economics, Dr. Rajendra Prasad Central Agricultural University, Pusa² Department of Agricultural Economics, School of Agri-Business & Rural Management, Dr. Rajendra Prasad Central Agricultural University, Pusa³SRI, Dr. Rajendra Prasad Central Agricultural University, Pusa PG 4..Research Scholar, Department of Agricultural Economics, Dr. Rajendra Prasad Central Agricultural University, Pusa**ABSTRACT**

This study explores the socio-economic profile of apple growers and the marketing constraints faced by producers and intermediaries in Shimla district of Himachal Pradesh. Primary data were collected from 120 farmers and 20 intermediaries in Theog, Mashobra, and Jubbal-Kotkhai blocks. Descriptive analysis and Garrett Ranking were used to assess household characteristics and prioritize key challenges. Findings revealed that a majority (61.67%) of the respondents were marginal farmers with an average landholding of 1.80 hectares, largely devoted to apple orchards. Despite moderate educational attainment and investment in orchard infrastructure, farmers reported major constraints including price fluctuation and middlemen exploitation (Garrett score: 72.51), adverse weather, and lack of technical knowledge. Intermediaries, including commission agents, contractors, wholesalers, and retailers, identified delayed payments, price volatility, and lack of proper storage and infrastructure as key operational challenges.

The study recommends strengthening price stabilization schemes, promoting transparent market practices, improving access to low-interest credit, and supporting Farmer Producer Organizations (FPOs). Enhancing irrigation, storage, and transport infrastructure is also essential for a more efficient and equitable apple value chain.

Keywords: Socio-economic analysis , Constraints, Garrett ranking, marketing, Apple Farming , Shimla , Himachal Pradesh (INDIA).

Physiological responses of coriander (*Coriandrum sativum* L.) genotypes under varying levels of moisture stress**Lokesh¹, Vijaykumar B Narayanapur¹, N K Hegde¹, H P Maheswarappa², Rekha B Chittapur³, G Bhuvaneshwari⁴ and Mahendra Belagumpi¹**¹Department of Plantation, Spices, Medicinal and Aromatic Crops, College of Horticulture, Bagalkot²Dept. of Agronomy, Central Plantation Crop Research Institute, Kasargodu, Kerala³Dept. of Biotechnology and Crop Improvement, College of Horticulture, Bagalkot⁴Deptment Post Harvest Management, College of Horticulture, Bagalkot
University of Horticultural Sciences, Bagalkot - 587 104 Karnataka (India)**ABSTRACT**

An investigation was carried out to evaluate the physiological responses of ten coriander (*Coriandrum sativum* L.) genotypes under varying levels of moisture stress with emphasis on relative water content (RWC), total chlorophyll content, proline accumulation, and membrane stability index (MSI) at College of Horticulture, Bagalkot. Moisture stress treatments (M₁: normal, M₂: moderate, M₃: severe) significantly influenced all parameters. A progressive decline was observed in RWC and chlorophyll with increasing stress levels, where mean RWC dropped from 71.98 % at M₁ to 51.63% at M₃ and mean chlorophyll content reduced from 15.45 SCMR to 10.47 SCMR units. Genotypes DCC-60 (70.59 % RWC, 16.53 SCMR) and DCC-64 (68.43% RWC, 15.37 SCMR) consistently maintained higher water status and pigment stability, indicating superior tolerance, while DCC-4 and DCC-23 recorded the

lowest values, suggesting high susceptibility. Proline content increased markedly under stress, from a mean of 4.32 $\mu\text{mol/g}$ FW at M₁ to 13.90 $\mu\text{mol/g}$ FW at M₃, with the highest accumulation in DCC-4 (22.36 $\mu\text{mol/g}$ FW) followed by DCC-23 and DCC-89, whereas tolerant genotypes such as DCC-60 (6.73 $\mu\text{mol/g}$ FW) and DCC-64 (7.40 $\mu\text{mol/g}$ FW) exhibited moderate levels, reflecting efficient osmotic adjustment without excessive accumulation. MSI decreased sharply with stress, from 66.77% at M₁ to 39.81% at M₃, yet DCC-60 (63.57%) and DCC-64 (61.80%) retained superior membrane stability compared to DCC-4 (43.06%) and DCC-23 (46.27%) which showed severe injury. The combined analysis of physiological traits confirmed that DCC-60 emerged as the most drought-tolerant genotype, followed by DCC-64 and DCC-56, while DCC-4 and DCC-23 were highly sensitive. The study concludes that RWC, chlorophyll retention, moderate proline accumulation and higher MSI can serve as reliable selection indices for identifying drought-tolerant coriander genotypes under water-limited conditions.

Keywords: Relative water content, membrane stability index, proline, moisture stress

Assessment of Growth, Yield, Nitrogen Use Efficiency, and Economics of Rice (*Oryza sativa*, L.) using precision Nitrogen Management Tools in Mid-Hills of Nepal

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ABSTRACT

Nitrogen is the most limiting nutrient in irrigated agroecosystems for cereal crops, and its mismanagement not only constrains yield but also contributes to greenhouse gas emissions, amplifying climate change. Even with the presence of multiple decision facilitation tools, farmers in the mid-hill region of Nepal still face significant difficulties in managing nitrogen (N) effectively in rice cultivation. A field study was undertaken during the rainy season of 2024 in Khumaltar, Lalitpur, to study the efficacy of targeted nitrogen management tools on the productivity, Nitrogen Use Efficiency (NUE), and profitability of rice. Seven treatments: Control (N₀), Farmers Fertilizer Practice (FFP), National Recommendation (NR), Leaf Color Chart (LCC) based N application, Soil Plant Analysis Development (SPAD) meter based N application, green seeker NDVI based N application, and Nutrient Expert (NE) were tested in a randomized complete block design with three replications. Among all treatments, NE recorded the highest number of effective tillers m⁻² (309.67), tiller panicle conversion index (96.79%), filled grains panicle⁻¹ (174.83), and thousand-grain weight (25.76 g). Grain yield was significantly higher in NE (6.79 Mt ha⁻¹), closely followed by NR (6.65 Mt ha⁻¹) and SPAD (6.45 Mt ha⁻¹). Results indicated that the B: C ratio was found to be the highest for NE (1.79), followed by NR (1.77), while SPAD meter-based N management showed higher NUE (FFP: 137.57; ANUE: 49.50). In contrast, the control treatment showed lower performance in terms of yield and economics. The findings demonstrate that site-specific and sensor-based N management strategies can significantly enhance resource use efficiency and resilience of rice production systems. In the context of climate change, precision N management emerges as a sustainable alternative to conventional practices, reducing production risks, minimizing environmental losses, and securing food and livelihood sustainability in rice-based agroecosystems.

Keywords: Nitrogen management, Nitrogen use efficiency, Precision agriculture, Rice productivity

The Effect of Climate Change on Public Health in Haor Regions of Bangladesh**Md. Farid Hasan^{1, a)}, Rajib Halder^{2, b)}, Dipankar Das^{3, c)}, Sayeed Md Ikram^{1, d)} and Mst. Mow^{4, e)}**¹*Department of Soil, Water & Environment, University of Dhaka, Dhaka 1000, Bangladesh.*²*Department of Development Studies, Daffodil International University, Bangladesh.*³*Department Of Computer Science and Engineering, University of Global Village (UGV), Barishal, Bangladesh.*⁴*Faculty of Agriculture, Hajee Mohammad Danesh Science & Technology University, Bangladesh.***ABSTRACT**

Abstract. The entire warming has steadily transformed into a serious worry that impacts the health of the entire population, and the Haor districts of Bangladesh are no exception. The goal of this study is to examine the influence of climate change on the health of the people in these locations, which are defined by their environmental and economic qualities. This study utilizes a mixed research strategy wherein the quantitative data acquired from the surveys is supported by the qualitative data collected from the interviews. The main data were gathered from the impacted populations, while the secondary data were meteorological data and health data. It is apparent that climate change, for instance, floods, and high temperatures have a direct influence on health, for instance, water-borne infections and respiratory issues. Also, the paper analyzes the adaptation techniques and the effectiveness of the area in preventing these health impacts. The report proposes the establishment of particular public health and climate change mitigation strategies to meet the requirements of the Haor areas. This research assists in expanding the understanding of the impacts of climate change on health and gives ideas for strengthening the resilience of other comparable susceptible places. Thus, the results of this study add to the knowledge of the complicated relationship between climate change and public health that is vital for policymakers, health care practitioners, and academics interested in climate change adaptation and health promotion.

Keywords: climate change, public health, Haor regions, Bangladesh, adaptation strategies, waterborne diseases, resilience.

Gras Salts As An Eco-Friendly Approach For Post-Harvest Disease Management In Banana**Poorvasandhya R*, Ezhilarasan P, Ezhilarasi A, Dheebadevi D and Chozhan K***Department of Plant Pathology, School of Agricultural Sciences, Dhanalakshmi Srinivasan University, Samayapuram, Tiruchirappalli, Tamil Nadu - 621112***ABSTRACT**

Banana (*Musa* spp.) is one of the world's most consumed tropical fruits and a vital contributor to food security and the economy. However, its highly perishable nature makes it vulnerable to post-harvest fungal diseases such as anthracnose (*Colletotrichum musae*) and crown rot, caused by a complex of pathogens. These infections significantly reduce fruit quality, shorten shelf life, and cause major economic losses during storage and transport. Although synthetic fungicides have been widely applied for post-harvest disease management, their use is limited due to concerns of chemical residues, human health risks, and pathogen resistance. Therefore, eco-friendly alternatives are essential for sustainable banana storage and marketing. Generally Recognized As Safe (GRAS) salts represent promising natural substitutes to chemical fungicides. In the present study, four GRAS salts-potassium sorbate, sodium benzoate, sodium carbonate, and sodium bicarbonate-were evaluated for their antifungal activity through *in vitro* and *in vivo* assays. Mycelial growth inhibition tests revealed differential responses among the treatments, with certain salts exhibiting strong fungistatic effects. *In vivo* fruit assays further demonstrated that treated bananas showed delayed symptom expression, reduced lesion development, and prolonged storage life compared to untreated controls. These findings highlight that GRAS salts, particularly potassium sorbate and sodium bicarbonate, can effectively suppress major post-harvest

pathogens of banana. Their safe, residue-free nature offers great potential as eco-friendly alternatives to hazardous fungicides, contributing to sustainable disease management and improving the storability of bananas in supply chains.

Keywords: Banana, potassium sorbate, sodium benzoate, sodium carbonate, sodium bicarbonate, post-harvest diseases and eco-friendly management.

The Role of Academic Physics Research in Accelerating Low-Carbon Technologies

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ABSTRACT

Academic physics research stands at the forefront of the transition to a low-carbon future, providing critical breakthroughs in both foundational knowledge and practical innovation. Physics forms the bedrock for understanding and optimizing energy conversion, storage, and transmission—key imperatives in sustainable technology deployment. For example, pioneering work in advanced materials has reduced the cost of solar electricity by an astounding factor of 100 over the past two decades. Research into perovskite solar cells has yielded rapid efficiency gains—from under 5% in 2009 to over 25% in 2020—making them a highly promising solution for scalable, cost-effective photovoltaic.

In the arena of energy storage, physicists are expanding the toolkit beyond lithium-ion batteries. Investigations into flywheel energy storage systems highlight their potential for long lifecycle, high power density, and minimal environmental impact, offering durable alternatives for grid-scale energy buffering. Academic research also plays an essential role in capturing and modelling the subtleties of climate dynamics and low-carbon transition mechanisms. Physicists contribute to the development of carbon capture and storage (CCS) technologies, including oxy-fuel and post-combustion capture methods, which are vital for mitigating emissions in heavy-industry sectors.

In sum, academic physics provides the intellectual and experimental infrastructure that accelerates the adoption of low-carbon technologies. From next-generation photovoltaic and smart energy systems to transformative storage and emissions mitigation, physics research is indispensable in engineering a sustainable, resilient transition to a low-carbon future.

Keywords: Carbon capture and storage (CCS), Lithium-ion batteries, Photovoltaic, Solar electricity.

Documentation of Constraints in the Functioning of Water User Associations in Mula Command Area

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ABSTRACT

This study was conducted on “Documentation of Constraints in the Functioning of Water User Associations in Mula Command Area”. This investigation seeks to offer insights into the required corrective actions to ensure the effective functioning of WUAs. The study documented the constraints encountered by office bearers in effective functioning of WUAs using ex-post facto research design and multistage sampling approach, collecting data from 57 directors of WUAs from Mula command area. Constraints were analyzed through Mean Percent Score, revealed that problems in volumetric water supply to individual farmers in absence of water measurement devices at farmers field level, canal officers do not take interest in solving water distribution related conflicts among the member farmers and non-cooperation from member farmers in recovery of current water charges and dues. These constraints collectively affect the effective functioning of WUAs in Mula command area. Tackling these diverse constraints with specific suggestions is essential for effective functioning of WUAs.

Keywords: Command Area, Effective, Functioning, Water User Associations.

Effects of climate change on the efficiency of pre and post-emergence herbicides in kharif maize (*Zea mays* L.) grown in Udaipur, Rajasthan**Himanshu Kuldeep and Dr. Arvind Verma***Department of Agronomy, Rajasthan College of Agriculture (MPUAT) Udaipur, Rajasthan***ABSTRACT**

Weeds impose serious problems in maize (corn) production, resulting in reduced crop yields and lower profits for farmers. Weeds cause around 52-80 per cent loss in the maize crop which necessitates their control. The magnitude of losses largely depends upon the composition of weed flora, period of crop-weed competition and its intensity. The usage of herbicides for the control of weeds has been the most prominent method among farmers. However, the continuous usage of similar herbicides can develop herbicide resistance which needs the exploration to newer herbicides. The use of pre-emergence and post-emergence herbicides as sequential or individual applications of these herbicides can be an effective way to manage weeds in maize. In order to realize the yield potential of maize, weed management becomes indispensable.

Climate change introduces multiple stressors that may reduce herbicide efficiency, elevated CO₂ concentrations can thicken leaf structure and reduce stomatal conductance, limiting foliar uptake of post-emergence herbicides. Temperature fluctuations, erratic rainfall and moisture stress impair both soil and foliar herbicide absorption. Heavy rain can lead to herbicide leaching, while dry soils may prevent adequate root uptake of pre-emergence treatments. Reduced microbial activity under dry conditions may also slow herbicide breakdown, potentially altering effectiveness. Weed biology and behaviour may shift under climate stress, with faster weed growth cycles and changes in species dominance that may evade existing herbicide regimes.

Keywords: Maize, Weed management, Herbicides, Climate change, Rainfed agriculture**Livestock–Climate Change Nexus: Impacts and Interactions****M. Vamshi***Dairy Extension Division, ICAR-National Dairy Research Institute, Karnal, 132001***ABSTRACT**

The intricate relationship between livestock and climate change offers a special chance for global sustainability as well as a significant challenge. The livestock industry's significant impact on global warming is typically overshadowed by the human population's heavy reliance on livestock and its products, such as milk and meat. A substantial contributor to land degradation and greenhouse gas emissions, the livestock production system, which produces milk and meat accounts for around 14.5% of all anthropogenic emissions worldwide. In contrast to the aforementioned claim, climate change is having an increasing impact on livestock systems through changes in disease prevalence, heat stress, weather patterns, and the availability of feed and water. Food security, rural livelihoods, and environmental health are all at risk due to this reciprocal interplay. This presentation explores the dual role of livestock as both a driver and a victim of climate change, highlighting regional disparities and system vulnerabilities. It also reviews innovative mitigation approaches, including dietary shifts, improved manure management, and climate-smart livestock practices. Understanding and addressing this mutual relationship is essential for developing resilient agricultural systems and achieving global climate goals.

Keywords: Climate Change, Livestock, Mitigation, Mutual Relationship**References:**

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Role of ICT Tools in Enhancing Climate-Resilient Paddy Farming Systems in Nepal
Udit Prakash Sigdel*Agriculture and Forestry University, Nepal***ABSTRACT**

Climate change is a pressing issue that significantly affects agriculture due to variations in temperature, rainfall, and other climatic parameters. Traditional extension approaches have recently become less effective as the agent-to-client ratio has increased sharply. In this context, ICT tools are gaining popularity for their ability to provide timely and precise information, conduct real-time needs assessments, and deliver appropriate solutions. To examine the role and impact of ICT tools in agriculture—especially in cereal crops—a study was conducted among 390 paddy farmers, randomly selected in equal numbers from Jhapa, Kapilbastu, and Bardiya districts. Structured interviews, focus group discussions (FGDs), and key informant interviews (KIIs) were used for data collection, while descriptive statistics, scaling techniques, and logit regression models were employed for analysis. The results indicated that paddy farmers had a moderate level of knowledge (0.44) regarding ICT tools, weather-based ICT services, and related applications. ICT use significantly enhanced awareness of climate variability and facilitated timely decision-making. Although farmers held positive perceptions of ICT tools, their actual usage was relatively low. ICT adoption was positively influenced by media exposure, ICT skills, and awareness, but negatively affected by age and education. ICT-based mechanization improved agricultural practices, reduced vulnerability to labor shortages, and minimized productivity losses. However, high costs, poor digital literacy, inadequate infrastructure, and limited localized content remained major constraints. Overall, the findings suggest that ICT tools, if adequately supported by policy, could play a crucial role in promoting climate-resilient, mechanized, and sustainable paddy farming systems in Nepal.

Keywords: ICT tools, climate change, agricultural extension, paddy farming, mechanization, Nepal

Role of Nitrogen for Quality Forage crops**Ankit Tiwari, Preeti and Shivam Singh***Tilka Majhi Agriculture College, (BAU,Ranchi) Jharkhand -834006**Chandra Shekhar Azad University of Agriculture & Technology- Kanpur -208002 Department Extension Education and Communication Management Acharya Narendra Deva University of Agriculture and Technology-224229***ABSTRACT**

Nitrogen plays a crucial role in enhancing quality of forage crops by influencing growth, nutrient concentrations, and biomass yield. Adequate N availability promotes vigorous vegetative growth, chlorophyll synthesis, and nutrient assimilation, leading to higher dry matter production. Furthermore, N content significantly improves crude protein content, digestibility, ADF, NDF and palatability, thereby increasing the nutritive value of forage for livestock. However, excessive use of N may result in nutrient losses by leaching, volatilization, and low nitrogen use efficiency. Hence, adopting efficient N management practices is vital for achieving sustainable and production of quality forage.

Keywords: Crude protein, Dry matter yield, Fodder quality, N management, N use efficiency,

Platforms for interdisciplinary knowledge exchange**Preeti***Chandra Shekhar Azad University of Agriculture & Technology- Kanpur -208002 Department Extension Education and Communication Management***ABSTRACT**

As global challenges become more complicated, such as climate change, public health, digital transformation, and social inequality traditional disciplinary silos often fall short in providing comprehensive solutions. In this context, **platforms for interdisciplinary knowledge exchange** have emerged as critical infrastructures for fostering dialogue, integration, and innovation across diverse domains of expertise. These platforms are digital networks viz., Researchgate and LinkedIn, collaborative workspaces, hybrid communities and formal institutions. They let experts from science, technology, the humanities, the arts, and policy share knowledge, do research together, and make things together. Importantly, they not only bridge academic fields but also connect academia with industry, government, and civil society. Common characteristics of successful interdisciplinary platforms include collaborative tool support, openness, accessibility, clear communication channels, and procedures for handling epistemological disputes. By creating environments where diverse perspectives can interact meaningfully, these platforms help generate novel insights, promote systemic thinking and build shared understanding. However, there are still issues, though, like institutional hurdles, disciplinary language, unequal access, and the requirement for new assessment measures that take into account multidisciplinary contributions. Policy support and deliberate platform design are needed to address this..

Keywords: Innovations, Interdisciplinary knowledge exchange, Knowledge exchange, Multidisciplinary approaches, Platforms,

Agrobiodiversity Conservation And Use Of Remote Sensing Approaches In Uttarakhand**Pooja Kala****ABSTRACT**

Agrobiodiversity, or agricultural biodiversity, and remote sensing are interconnected fields that play crucial roles in sustainable agriculture and food systems. Agrobiodiversity refers to the variety of life in agricultural systems, encompassing crops, livestock, and the ecosystems that support them. Remote sensing, using technologies like satellite imagery and drone-based sensors, provides valuable data for monitoring and managing agrobiodiversity. Extended Summary Agrobiodiversity, encompassing the variety and variability of animals, plants, and microorganisms within agricultural ecosystems, is crucial for food security, livelihood resilience, and sustainable agricultural practices. However, the continued decline of agrobiodiversity due to factors like land-use changes and agricultural intensification necessitates effective monitoring and management strategies. This is where remote sensing (RS) emerges as a powerful tool. Remote sensing techniques, including multispectral, hyperspectral, and thermal imaging from satellites or drones, can accurately identify different crop types, map their distribution, and assess changes in land cover over time. This information is crucial for understanding and managing crop diversity on a larger scale. It provides insights into vegetation health, vigor, and chlorophyll content, allowing for early detection of issues like drought, diseases, or nutrient deficiencies. Timely intervention based on this data can help protect crops, reduce losses, and maintain agrobiodiversity within agricultural systems. It can assess soil characteristics like texture, compaction patterns, and moisture levels, which directly impact crop growth and the overall health of the agroecosystem. Understanding and managing soil conditions are vital for promoting healthy plant communities and sustaining agrobiodiversity and provide data on factors like water availability and

nutrient requirements, RS enables the implementation of precision agriculture practices. This targeted approach optimizes the use of resources such as water and fertilizers, reducing environmental impact and promoting sustainable agriculture, thereby indirectly benefiting agrobiodiversity and support climate resilience. It allows monitoring of changes in agricultural landscapes, including the expansion of cultivated areas, changes in cropping patterns, and land degradation. This helps assess the impact of these changes on agrobiodiversity and informs policy for sustainable land management.

Entrepreneurship Education And Knowledge Dissemination: Fostering Learning For Sustainable Green Energy Solutions

Vijaya Tomar

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ABSTRACT

In an era marked by climate crisis and the pressing need for sustainable energy alternatives, forging a pathway to green transformation has become paramount. Entrepreneurship education (EE), especially when directed toward sustainable green energy solutions, holds millions of untapped potentials for catalysing innovation. The purpose of this study is to examine how EE curricula can disseminate knowledge effectively and cultivate learners' entrepreneurial mindsets and competencies—particularly in the context of green energy innovation. Specifically, this paper investigates how knowledge dissemination strategies within EE influence learners' ability to conceive, develop, and potentially launch sustainable green energy ventures. To address these objectives, a mixed-methods approach was adopted. First, a questionnaire comprising multiple-choice questions was administered to 120 university students enrolled in entrepreneurship and environmental engineering programs to measure exposure to EE modules, perceived knowledge acquisition in green energy, entrepreneurial intention, and learning preferences. The quantitative data were analyzed with descriptive statistics and correlation assessment. The results revealed that the students exposed to active-learning strategies such as simulations, serious games, and problem-based projects report significantly higher confidence in green energy knowledge and entrepreneurial competence. A strong positive correlation ($r = 0.62$, $p < 0.01$) was observed between knowledge dissemination via experiential pedagogy and self-reported intention to pursue green energy ventures. The study showed that the students preferred blended learning formats that included digital simulations combined with real-world project-based learning; purely lecture-based formats were least effective. The findings suggest that EE geared toward green energy is most effective when learning is active, scaffolded through simulations or serious games, and grounded in real-world challenges. Pedagogies like game-based learning (e.g., SimVenture, FLIGBY) and Transformative Enterprise Education (TrEE) frameworks have shown promise in developing ethical, sustainability-oriented mindsets (see review literature). In conclusion, entrepreneurship education aimed at green energy should leverage innovation-focused, experiential learning approaches and knowledge flows that transverse academia, industry, government, and civil society. This fosters a learning ecosystem where students not only gain knowledge but develop the mindset and confidence needed to act sustainably.

Keywords: entrepreneurship education, knowledge dissemination, sustainable green energy, serious games, experiential learning, entrepreneurial intention, sustainable education.

Community Resilience: Climate Change and Women's Health**Vaishali B. Katke****ABSTRACT**

Climate Change can significantly affect women's health in particular, in addition to resources and animals. These are more of an issue for women from underrepresented groups who work long hours outside in hotter climates. The growing problems among socially disenfranchised women in lower castes and classes in arid and sub-arid regions can be lessened by community resilience in the form of awareness and transformation. This paper investigates the effects of climate change on women's health and how community resilience to climate change, through awareness-building strategies and the mobilization of community members, can support women's health in the community.

Keywords: Climate change, Impacts, Resilience, Awareness, Community-driven.

Role of Nitrogen for Quality Forage crops**Ankit Tiwari, Preeti and Shivam Singh***Tilka Majhi Agriculture College, (BAU,Ranchi) Jharkhand -834006**Chandra Shekhar Azad University of Agriculture & Technology- Kanpur -208002 Department Extension Education and Communication Management**Acharya Narendra Deva University of Agriculture and Technology-224229***ABSTRACT**

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Keywords: Crude protein, Dry matter yield, Fodder quality, N management, N use efficiency,

Platforms for interdisciplinary knowledge exchange**Preeti***Chandra Shekhar Azad University of Agriculture & Technology- Kanpur -208002 Department Extension Education and Communication Management***ABSTRACT**

As global challenges become more complicated, such as climate change, public health, digital transformation, and social inequality traditional disciplinary silos often fall short in providing comprehensive solutions. In this context, **platforms for interdisciplinary knowledge exchange** have emerged as critical infrastructures for fostering dialogue, integration, and innovation across diverse domains of expertise. These platforms are digital networks viz., Researchgate and LinkedIn, collaborative workspaces, hybrid communities and formal institutions. They let experts from science, technology, the humanities, the arts, and policy share knowledge, do research together, and make things together. Importantly, they not only bridge academic fields but also connect academia with industry, government, and civil society. Common characteristics of successful interdisciplinary platforms include collaborative tool support, openness, accessibility, clear communication channels, and procedures for handling epistemological disputes. By creating environments where diverse perspectives can interact meaningfully, these platforms help generate novel insights, promote systemic thinking and build shared understanding. However, there are still issues, though, like institutional hurdles, disciplinary language, unequal access, and the requirement for new assessment measures that take into account

multidisciplinary contributions. Policy support and deliberate platform design are needed to address this.

Keywords: Innovations, Interdisciplinary knowledge exchange, Knowledge exchange, Multidisciplinary approaches, Platforms,

Vasudhev Kutumbkam - an inclusive approach to control and manage the climate change and its effects.

Sanjay Mudgal

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Purpose

Climate change poses a significant threat to the planet, necessitating a holistic approach to mitigate its impacts. Vasudhev kutumbkam, an ancient Indian philosophy emphasizing the interconnectedness of all living being and the earth, offers a profound framework for addressing this global challenge. By embracing the concept of "the world as one family" individuals, communities and nations can work together to promote sustainable practices, reduce carbon footprints and protect the environment.

The Present Study Begins with a question to myself

Where are we going? When I saw people crying and drowning in devastating flood waters. When I saw People Committing Suicide because they lost their everything in a tsunami? When I saw People went breathless and falling on the ground just like a rootless tree during Covid Pandemic? When I saw animals, birds, Humans And plants fully burnt to death in the devastating Jungle fires in Australia? The Picture of a Child who was sitting in front of her home which was totally blown of by a missile! And many such pics and conditions, as a human moved me to find a permanent solution to stop such disasters to the human race?

Can we create global leaders based on the ancient Indian philosophy VASUDHEV - KUTUMBKAM, who can think beyond geographical boundaries.

Vasudhev Kutumbkam :- The whole world is one family.

Sarve Bhavantu Sukhina :- May all be Happy.

Sarve Santu Niramaya :- May all be free from illness.

Sarve Bhadrani Pashyantu :- May all See auspicious things.

Maa Kashichit Dukhbhagva Bhawed :- May no one suffer in any way.

Material, Methods and Implementation

In this study investigations will be carried out with a questionnaire and personal observation, A sample size of 50 consisting eminent

people from the Universe intellectuals, academia, ambassadors, politicians bureaucrats, ministers, foreign travellers, common people and diplomats will be interviewed. Besides written questions observation technique will also be used. Exploratory research method will be used. The idea is to implement the ancient Indian wisdom of vasudhev kutumbkam into real life scenario. For this the decision makers in the west, east and the whole world will be introduced with the most effective tool from mahaupnishad 6.71-75 Vasudhev kutumbkam means the whole world is my family. This Philosophy was introduced to world leaders during the G20 summit in India. Where Indian prime minister Mr Narendra Modi introduced the concept of One World One Dream One destination to the world leaders.

Education and Awareness :- Promoting awareness about vasudhev kutumbkam and its relevance to climate change can inspire individuals and communities to adopt sustainable lifestyles. Encourage school to teach global citizenship and cultural empathy, fostering a generation that values global unity and cooperation.

Policy Frameworks :- UNO and Governments can develop policies that incorporate the principals of vasudhev kutumbkam, encouraging sustainable development and environmental protection.

Global Partnerships :- Fostering international collaborations and partnerships can facilitate the sharing of best practices, technologies and resources to address climate change.

Conclusion

The World will Become a better place To live For our Coming generation that Includes not only humans but also all the stake holders on our planet i.e our environment, climate, birds, animals, ants, trees etc. Vasudheva Kutumbkam offers timeless wisdom that can guide us and our global leaders in addressing contemporary global challenges. By embracing this Philosophy, we can create global leaders who will foster a sense of global family, peace, harmony and sustainability. And this sustainability will prevail in the whole world beyond narrow geographical boundaries.

Keywords: Vasudhev Kutumbkam, Sarve Santu Niramaya, Sarve Bhavantu Sukhina, Ma Kashid Dukhbhagvaved, Inclusive, Global

Cholesterol-Degrading Actinobacteria from Mangroves: Bridging Climate-Impacted Ecosystems with Biomedical Applications”

Monu Bala

S.S.J.P.G. College Syalde Almora.

ABSTRACT

Mangrove ecosystems, among the most productive yet highly vulnerable biomes, are under severe threat due to the accelerating impacts of climate change, including sea-level rise, salinity fluctuations, and habitat loss. These unique environments harbor diverse microbial communities, particularly Actinobacteria, which represent an untapped reservoir of novel bioactive compounds with significant biomedical and biotechnological potential. In the present study, marine Actinobacteria were isolated from the Bhitarkanika mangrove ecosystem, Odisha, India, the country's second largest mangrove forest and a biodiversity hotspot. A total of 1,200 isolates were obtained, of which 48 strains demonstrated cholesterol-degrading ability through extracellular cholesterol oxidase (ChOx) production. ChOx is an industrially and medically important enzyme, second only to glucose oxidase in diagnostic applications, and is employed in clinical assays, sterol metabolism studies, and pharmaceutical steroid synthesis. The cholesterol-oxidizing strains identified, primarily belonging to *Rhodococcus* species, were characterized using morphological features and 16S rRNA gene sequencing.

Our findings highlight how mangrove-associated Actinobacteria can serve as a sustainable biotechnological resource for addressing lifestyle-related diseases such as atherosclerosis and hypercholesterolemia, both of which are expected to rise with global climate-driven changes in diet and health burden. Furthermore, the identification of robust ChOx-producing microbes tolerant to saline and fluctuating environments offers promise for industrial-scale enzyme production with enhanced stability against organic solvents and detergents. Thus, this work bridges environmental microbiology, biomedical sciences, and biotechnology by demonstrating how microbial diversity from climate-sensitive habitats can be harnessed for human health applications, while simultaneously underscoring the urgency of conserving these ecosystems in the face of climate change.

Keywords: Cholesterol oxidase, Actinobacteria, Mangroves, Climate change, Biomedical applications, Biotechnology

Economic analysis of Blackgram varieties under *Pterocarpus marsupium* based agroforestry System

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ABSTRACT

The present investigation entitled “Economic analysis of Blackgram varieties under *Pterocarpus marsupium* based agroforestry System” was carried out at Agroforestry Research Field, RVC Campus, B.A.U. Kanke, Ranchi with Randomized Block Design (RBD) consisting of 4 replication and 9 treatments viz. T₁ - *Pterocarpus marsupium* + Urd (Var. Birsa Urd-1), T₂ - *Pterocarpus marsupium* + Urd (Var. Birsa Urd-2), T₃ - *Pterocarpus marsupium* + Urd (Var. WBU-109), T₄ - *Pterocarpus marsupium* + Urd (Var. Uttara), T₅ - Sole *Pterocarpus marsupium*, T₆ - Sole Birsa Urd-1, T₇ - Sole Birsa Urd-2, T₈ - Sole WBU-109 and T₉ - Sole Uttara. Cost of cultivation for different treatments was found more under combinations as compared to sole cropping because of cost addition in different operation. Maximum cost (₹ 49457 ha⁻¹) incurred by T₃ - *Pterocarpus marsupium* + Urd (Var. WBU-109) and least amount (₹ 22485 ha⁻¹) incurred by T₅ - Sole *Pterocarpus marsupium*. Maximum gross return (₹ 90816 ha⁻¹) obtained by T₆ - Sole Birsa Urd-1 followed by T₁ - *Pterocarpus marsupium* + Urd (Var. Birsa Urd-1) (₹ 87371 ha⁻¹) and T₉ - Sole Uttara (₹ 84942 ha⁻¹) whereas, maximum net return (₹ 57923 ha⁻¹) was found in T₆ - Sole Birsa Urd-1. Benefit cost ratio was maximum in T₆ - Sole Birsa Urd-1 (2.76) and whereas, minimum was found in T₃ - *Pterocarpus marsupium* + Urd (Var. WBU-109) (1.45). It was found more under sole cropping as compared to combination might be due to initial age of *Pterocarpus marsupium*. But in future Intercrops will be a source of additional income to the growers rather keeping the interspace fallow. The financial benefits were more in the intercropping system as compare to the sole cropping systems, and it may reduce the risk of crop failure and compensate the return from the trees.

Keywords: Blackgram, *Pterocarpus marsupium*, Benefit cost ratio, Economics, Agroforestry.

Synergistic Impact of Sulphur and Boron on Yield, Nutrient Uptake, and Efficiency in Lentil (*Lens culinaris* Medik.) Cultivated in Alfisols

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ABSTRACT

Lentil (*Lens culinaris* Medik.), a nutritionally rich legume, often suffers from low productivity and poor seed quality due to the deficiencies of sulphur (S) and boron (B) in Alfisol soils. This study aimed to evaluate the interactive effects of graded levels of S and B on lentil performance in terms of seed quality, nutrient uptake, and use efficiency. A controlled two-year pot experiment was conducted under a Factorial Randomized Block Design, comprising 16 treatment combinations involving four levels each of sulphur (0, 15, 30, and 45 kg S ha⁻¹ as gypsum) and boron (0, 1, 2, and 3 kg B ha⁻¹ as borax), applied along with the recommended dose of nitrogen (N), phosphorus (P₂O₅), and potassium (K₂O).

The results demonstrated that increasing S up to 45 kg ha⁻¹ and B up to 2 kg ha⁻¹ significantly enhanced the uptake of N, P, K, S, and B, lentil yield, and the partial factor productivity (PFP) of major nutrients. A synergistic interaction between S and B was observed, with combined applications outperforming individual nutrient applications. The treatment with 45 kg S ha⁻¹ and 1 kg B ha⁻¹ improved agronomic efficiency by 11.78% (S) and 90.79% (B), respectively, compared to treatments with 30 kg S ha⁻¹ and

3 kg B ha⁻¹. The highest apparent recovery efficiency was recorded at 30 kg S ha⁻¹ (19.17%) and 1 kg B ha⁻¹ (77.78%).

Furthermore, sulphur application significantly reduced the N:S ratio in both seeds (4.63%) and stover (7.20%), thereby enhancing seed protein quality. Stepwise multiple regression analysis revealed that phosphorus concentration in seeds was the most significant contributor to biological yield, followed by sulphur. Optimal improvements in seed protein content, nutrient uptake, and yield were achieved with 45 kg S ha⁻¹ and 2 kg B ha⁻¹, emphasizing the crucial role of balanced S and B nutrition in enhancing lentil productivity and quality on nutrient-deficient Alfisols.

Keywords: Lentil, Alfisol, sulphur, boron, nutrient uptake, nutrient use efficiency, seed protein quality, N:S ratio, gypsum, borax

Formulation of Bio-Fortified Pearl Millet (*Pennisetum glaucum*) products with their Nutritional and Sensory evaluation

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ABSTRACT

Iron deficiency anaemia is a major micronutrient deficiency worldwide. Bio-fortification of staple foods plays an important role in reducing anaemia. Bio-fortified pearl millet offers a new and practical approach to Indian consumers to combat anaemia. This study aims to make the millet ready to eat form for consumption with some enhanced nutritional properties. Biscuit, Cake, Millet Bar and mix were prepared using processing methods (germination) with Bio-fortified pearl millet variety (RHB-233) as main ingredient. These ready to eat products were prepared with the ingredients soybean flour, Amla powder, Moringa powder, sesame seed, groundnut, milk powder and carrot powder. The nutrient profile of pearl millet both processed and unprocessed along with recipes has been analyzed. Nutrient contents of moisture, protein, fat and mineral (calcium, iron and zinc) increased significantly after germination. All the products prepared were nutritionally superior with good overall acceptability. The protein and iron content was found to be highest in mix recipe among all the recipes. While, fat content was recorded highest in biscuits.

Keywords: Bio-fortified, Pearl millet, Anaemia, Nutritional properties, Biscuit

Estimation of genetic parameters of variability for yield and yield related traits in maize (*zea mays* L.) Hybrids

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ABSTRACT

Maize (*Zea mays* L.; 2n = 20) is a monoecious, cross-pollinated crop and has wide scope for the development of hybrids and composites. Composites occupy major area in our country but these are poor yielders. Therefore, considering the importance of recently single cross hybrids developed through superior inbreds need to be promoted. Thus, there is a tremendous scope for increasing production and productivity. However, for any breeding programme, germplasm which serves as a valuable source material as it provides scope for building of genetic variability. Among a series of routine activities in the breeding program, selection (the effectiveness of selection determined by the selection criteria used) is the most important step for obtaining high yielding genotypes. Information on genetic parameters

such as heritability can be used as a consideration to determine selection criteria. The field experiments were laid out in randomized block design with three replications and thirty hybrids at IARI-Sipani Krishi Anusandhan Farm, Collaborative Outstation Research Centre, Sitamahu Road Changli, Mandsaur (M.P.). Crop was raised during *Kharif* -2022-23. Five competitive plants were randomly selected from each replication in a genotype for recording observation of thirteen quantitative characters viz. days to 50% tasseling, days to 50% silking, plant height, ear height, cob length, cob girth (Cob Diameter), number of kernel rows per cob, 100 -Grain weight /cob after shelling, 100 grain Weight, number of plant stand per plot, kernel texture (Flint/Dent), grain yield per plot (Kg) and days to maturity (Days). The average mean squares from revealed that the mean squares due to genotypes were highly significant for all the characters indicating the presence of significant genetic variability in the material under the study. It provides the scope for selection and further subsequent utility of the genotype in the crop improvement programme. High GCV was recorded for grain yield per plot (32.59%), number of plant stand per plot (17.27%), ear height (13.99%), test weight (11.68%) and number of kernels row in per cob (10.90%). Therefore, selection for all these characters would be effective. Heritability (broad sense) estimates were high (>50%) for all the traits except days to maturity (47.36%). The estimates of heritability in broad sense, more than 80% was recorded for plant height, ear height, cob length, number of kernels row in per cob, test weight, number of plant stand per plot and grain yield per plot. High genetic advance as percentage of mean (genetic gain) along with estimate of heritability was observed for traits ear height, cob length, number of kernels row in per cob, test weight, number of plant stand per plot and grain yield per plot which shows additive gene effects on these characters. Therefore, it appeared from the present study that the characters like test weight, ear height, cob length and number of kernels row in per cob be exhibiting predominance of additive gene effects. Hence, simple selection based on phenotypic observations would be effective for these characters to bring genetic improvement in desired direction.

In vitro* Evaluation of fungicides against mycelial growth of chickpea wilt caused by *Fusarium oxysporum* f. sp. *ciceri

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ABSTRACT

Chickpea (*Cicer arietinum* L.) is an important annual legume crop of the family *Fabaceae*. Wilt disease is a major constraint to chickpea production due to the occurrence of wilt of chickpea. Causal organism of wilt *Fusarium oxysporum* f. sp. *ciceri* (Padwick) synd. and Hans. Six fungicides were evaluated in the controlled condition by poisoned food techniques against wilt of chickpea pathogen. All the tested fungicides showed significantly higher mycelial growth inhibition over the control. Among these fungicides, carbendazim 50% WP and tebuconazole 25%+ trifloxystrobin 50% 75WG recorded maximum mycelial growth inhibition at 100 ppm, 200 ppm and 300 ppm concentrations, respectively. Carbendazim 50% WP recorded 75.65, 89.34 and 95.44 per cent inhibition of growth at 100 ppm, 200 ppm and 300 ppm, respectively. Tebuconazole 25%+ trifloxystrobin 50% 75 WG inhibited mycelial growth with 73.78, 78.43 and 88.22 per cent at 100 ppm, 200 ppm and 300 ppm, respectively. Fosetyl AL 80% WP was found least effective with inhibition of mycelial growth with 36.39, 46.65 and 57.21 per cent at 100 ppm, 200 ppm and 300 ppm concentration, respectively. Maximum mean mycelial growth inhibition was recorded in carbendazim 50% WP (86.81%) and followed by tebuconazole 25%+ trifloxystrobin 50% 75WG (80.14%), copper oxy chloride 50% WP (70.07%), azoxystrobin 25%SC (58.36%) mancozeb 75% WP (50.53%) and fosetyl AL 80% WP (46.75%).

Keywords: Chickpea, Mycelial growth, fungicides, maximum mycelial

Farmers Adaptation Strategies in Turmeric Cultivation in Thoubal District of Manipur
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ABSTRACT

Agriculture remains highly susceptible to the effects of climate change, as it is among the most directly and severely impacted sectors by changing weather patterns and extreme climate events. Turmeric cultivation, in particular, has been adversely affected, with noticeable declines in yield attributed to these climatic shifts. As a result, there is growing attention on the development and implementation of adaptation strategies to mitigate the negative consequences of climate change on agricultural production. This study aimed to investigate the perceived impacts of climate change on turmeric cultivation as experienced by turmeric farmers, and to examine the adaptation strategies they have employed in response. Data were collected from a purposively selected sample of 111 turmeric farmers through in-depth personal interviews. Analysis revealed that 88 farmers had adopted one or more strategies to adapt to climate-related challenges, while 23 farmers had not undertaken any specific adaptation measures. Findings indicated that a significant proportion of the farmers (44.14%) exhibited a medium level of adaptation, followed by 35.14% who demonstrated a low level, and 20.72% who had adopted a high level of adaptation strategies in their turmeric farming practices. These results highlight the varied responses among farmers and underscore the need for increased support and dissemination of effective climate adaptation practices in the turmeric sector.

Keywords: Climate change, turmeric, adaptation strategies, majority.

Effect of different temperature level on mycelial growth of *Rhizoctonia solani* under *in vitro* condition

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ABSTRACT

Fenugreek (*Trigonella foenum-graecum* L.) is an annual legume and spice crop renowned for its medicinal, pharmaceutical, and nutraceutical properties. It is believed to have originated in the Mediterranean region. Root rot disease of fenugreek (*Trigonella foenum-graecum* L.) caused by *Rhizoctonia solani* has become an important hindrance to the farmers in Rajasthan. The disease is widely occurred in sandy soil of Rajasthan, where the climatic conditions are very adverse, due to dry and high temperature. The pathogen *Rhizoctonia solani* survives as saprophyte in mycelial form by colonizing in soil organic matter. It can also survive by producing sclerotia which are irregular in shape, small in size (1-3 mm diameter) and brown to black structures present in soil and plant tissue. The fungal sclerotia and the mycelia overwintering in soil and crop residues germinate and develop new hyphae which infect new standing crop. In the present investigation five different temperature viz., 15°C, 20°C, 25°C, 30°C and 35°C were tested on mycelium growth of *R. solani* under *in vitro* conditions. Among the different level of temperatures highest mycelial growth was recorded at 30°C (46.33 mm) followed by 25°C (36.33 mm), 35°C (22.00 mm), 20°C (15.00 mm) and found least at 15°C (7.00 mm).

Keywords: Pharmaceutical, nutraceutical, mycelial growth.

**Disease intensity of Pestalotia leaf spot (*Pestalotia longisetula*) of strawberry in Himachal Pradesh
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ABSTRACT

Strawberry (*Fragaria × ananassa* Duch.) is an important fruit of the family Rosaceae. Strawberry fruits are attractive with pleasant aroma, good flavour and are also rich in vitamin-C (39 to 86mg/100g fruit) and minerals. The flavour of the fruit is attributed to the presence of volatile esters which varies among cultivars. To study the disease intensity of Pestalotia leaf spot (*Pestalotia longisetula*), periodic survey of strawberry growing areas of Solan and Sirmour districts of Himachal Pradesh was conducted during 2017 cropping season. It is evident from the data that the disease was prevalent at all the locations in Solan and Sirmour districts of Himachal Pradesh. The incidence of leaf spot ranged from 6.53 to 22.87 per cent and severity ranged from 4.44 to 17.77 per cent. In Solan district, highest incidence and severity was recorded at Nauni (22.21, 16.66 %) followed by Mandholghat (20.25, 13.33 %). Further, lowest incidence and severity was recorded at Piplughat (15.99, 10.00 %). In Sirmour district, highest incidence (22.87 %) and severity (17.77 %) of Pestalotia leaf spot was recorded at Dhaulakuan and lowest incidence (6.53 %) and severity (4.44 %) was recorded at Baghthan. Overall data revealed that the incidence and severity of the leaf spot was higher in Solan district than Sirmour district.

Keywords: Pestalotia, disease, survey, diseases incidence and disease severity.

Development and Evaluation of Botanical Based Silkworm Bed Disinfectant

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ABSTRACT

Maintaining good hygiene is essential for healthy silkworm (*Bombyx mori* L.) rearing since it helps prevent the spread of harmful microorganisms. The study was conducted in Division of Sericulture, SKUAST-Jammu in the spring season of year 2021. In this study, we developed several herbal disinfectant powders, using different plant parts, at SKUAST-J and compared their effects with a standard product (Vijetha) and a control group. All three herbal formulations worked well, but Formulations 2 and 3 (T2, T3) stood out as the most effective, reducing the incidence of disease to as low as 2-4%. These two treatments also led to heavier silkworm larvae and improved pupation rates. Notably, the number of flimsy cocoons dropped significantly, from 10.33% in the control group to just 5.33% with the best formulations, and the total larval development period was shortened. We also saw a clear improvement in silkworm performance: the number of healthy silkworms reaching maturity increased from 8,338 in the control to 9,354 in T2 and 8,889 in T3. The total weight of mature silkworms was highest with Formulation 2 (14.18 kg) and Formulation 3 (11.41 kg), compared to just 9.9 kg in the control. Individual cocoon and shell weights were also better in the herbal treatment groups. The shell ratio improved, rising from 19.45% in the control to 22.25% in T2 and 20.72% in T3. Remarkably, both the total and non-breakable filament lengths increased with the herbal disinfectants—total filament length reached 1,087 m in T2 and 869 m in T3, up from 843 m in the control, and non-breakable length went from 787 m (control) to 1,038 m (T2) and 869 m (T3). Denier values, which indicate filament thickness, were slightly lower in T2 and T3, suggesting finer silk. Overall, our findings show that the new herbal disinfectant formulations made at SKUAST-J can significantly improve silkworm health and cocoon quality, making them promising alternatives to standard chemicals in sericulture.

Keywords: Disinfectant, silkworm, herbal.

Effect of seed inoculation of zinc and iron solubilizing bacteria on growth, yield and quality attributes of maize**Ravi Kumar, Kehar Raja and Gajveer Meena***Division of Soil Science, SKUAST-Kashmir (J&K), India***ABSTRACT**

This study examines the effects of inoculating seeds with zinc and iron-soluble bacteria (ZSB and ISB) on maize (*Zea mays* L.) growth, yield, and quality characteristics. Micronutrient deficits are common in agricultural soils, especially those of iron (Fe) and zinc (Zn), which reduce crop productivity and nutritional quality. In this context, bio-inoculants capable of solubilizing zinc and iron offer an eco-friendly and sustainable approach to enhance nutrient availability to plants. A field experiment was conducted using maize seeds inoculated with efficient strains of ZSB and ISB, both individually and in combination, along with an uninoculated control. Seven different treatment combinations were applied in the experiment, including three different doses of zinc and iron (0, 20, 25, and 30 kg ha⁻¹ ZnSO₄ and FeSO₄) and two zinc and iron solubilizers (*Pseudomonas striata*, *Pseudomonas fluorescence*) were used in RBD (Randomized Block Design). The results emerged out clearly indicate that plant height, leaf area, and total chlorophyll were significantly increased due to zinc and iron solubilizing bacterial culture and doses of zinc and iron up to 30 kg ha⁻¹ ZnSO₄ and FeSO₄ with RDF. Significantly higher grain and straw yield of maize was recorded with the treatment RDF + 30 kg ha⁻¹ ZnSO₄ + 30 kg ha⁻¹ FeSO₄ + seed inoculation of Zn and Fe solubilizers. The quality parameters like protein content and test weight improved significantly due to inoculation of zinc and iron solubilizing bacteria. This study emphasizes the potential of zinc and iron solubilizing bacteria as a promising biofertilizer approach for enhancing maize yield, nutritional content, and soil health in a sustainable manner.

Keywords: Solubilizing bacteria, Eco-friendly, Nutrient availability, Seed inoculation.

Enhancing Maize Yield and Nutrient Uptake through Microbial Inoculants and Consortia under Vertisol Soil Conditions**Gajveer Meena, Ravi Kumar and Manish Kumar***Division of Soil Science, SKUAST-Kashmir (J&K), India***ABSTRACT**

This study explores the compatibility and synergistic influence of microbial inoculants and their consortia on the growth performance, yield attributes, and nutrient uptake efficiency of maize cultivated on Vertisols. The field experiment was laid out in a Randomized Block Design (RBD) comprising ten treatment combinations involving individual and consortia applications of key microbial bioinoculants. These included *Azospirillum*, *Bacillus megaterium*, *Frateruria aurantia*, *Thiobacillus thiooxidans*, and *Pseudomonas striata* in various dual and multi-strain combinations. Maize seeds were treated with microbial formulations at a rate of 10 ml kg⁻¹ of seed, supplemented with the recommended dose of fertilizers (RDF) applied at sowing. Among all treatments, T10 (*Azospirillum* + *Bacillus megaterium* + *Pseudomonas striata* -Consortia VII) recorded the highest grain yield (8156.00 kg ha⁻¹), stover yield (9836.66 kg ha⁻¹), and significantly improved total nutrient uptake-nitrogen (395.00 kg ha⁻¹), phosphorus (99.99 kg ha⁻¹), and potassium (170.65 kg ha⁻¹). The integration of microbial consortia with conventional fertilization not only enhanced nutrient use efficiency but also promoted plant vigor and productivity under Vertisol conditions. These findings highlight the potential of microbial consortia as a sustainable agronomic intervention for improving soil fertility and achieving higher maize productivity with reduced chemical dependency. This integrated approach can play a critical role in advancing nutrient-efficient and climate-resilient maize production systems, particularly in resource-constrained or ecologically sensitive regions.

Keywords: *Azospirillum*, Bioinoculants, Microbial consortia, Nutrient uptake Vertisols.

Sustainable Farming for Safe Food: The Role of Organic and Residue-Free Systems**Harman Singh***Division of Soil Science, SKUAST- Kashmir (J&K), India***ABSTRACT**

The growing concerns over food safety, environmental degradation, and public health have prompted a global shift toward more sustainable agricultural practices. Among the most promising approaches are organic farming and residue-free food production, both of which aim to minimize chemical inputs while ensuring safe, nutritious, and ecologically responsible food. These systems offer viable alternatives to conventional farming, which often depends heavily on synthetic fertilizers, pesticides, and genetically modified organisms. Organic farming promotes long-term sustainability by emphasizing soil health, biodiversity, and the use of natural inputs such as compost, biofertilizers, and biological pest control. It eliminates the use of synthetic agrochemicals, resulting in food that is free from harmful residues and rich in nutritional value. Residue-free food production, on the other hand, allows for limited, regulated chemical use early in the crop cycle, ensuring that no detectable pesticide residues remain at harvest. This system serves as a transitional model for farms not yet equipped to go fully organic, while still addressing consumer demand for clean and safe produce. Both systems offer benefits such as safer food, improved soil and water health, and access to premium markets. However, challenges like lower yields, limited farmer knowledge, and certification issues can slow their adoption. To expand these practices, support is needed through better policies, farmer training, consumer awareness, and research. Together, organic and residue-free farming can play a vital role in building a sustainable agricultural future that protects both people and the planet.

Keywords: Organic Farming, Residue-Free Food Production, Sustainable Agriculture, Food Safety, Chemical Residues.

Status of Bipolaris Leaf Spot Disease (*Bipolaris setariae*) of Pearl millet in Rajasthan**Vinay Kumar Kardam¹, A K Meena¹ and Santra Devi²**¹*Dr BRC Agricultural Research Station, Agriculture University, Mandor- Jodhpur (342304) INDIA*²*School of Agriculture and Veterinary Science, Shridhar University, Pilani- Jhunjhunu, INDIA***ABSTRACT**

The survey on the Bipolaris leaf spot of pearl millet caused by *Bipolaris setariae*, was carried out to know the prevalence and distribution of the disease in ten districts of Rajasthan viz., Bikaner, Sri Ganganagar, Hanumangarh, Jodhpur, Jaipur, Sikar, Alwar, Bharatpur, Churu, Dausa and one district of Haryana i.e. Hisar during *Kharif* 2019 and *Kharif* 2020 at panicle emergence and flowering stages. In this present investigation, the data revealed that overall higher per cent disease incidence and per cent disease severity were observed in Sri Ganganagar (64.88 and 32.02%) district followed by Hanumangarh (61.88 and 28.08%), Alwar (59.25 and 25.21%), Bharatpur (57.91 and 23.83%), Jodhpur (56.40 and 22.02%), Bikaner (55.24 and 20.25%), Jaipur (53.15 and 18.29%), Sikar (51.13 and 17.29%), Dausa (49.49 and 15.52%), Churu (47.37 and 13.09%) and Hisar (45.38 and 11.26%) districts. The deshi/ local varieties were found to be more susceptible to infection of *B. setariae* (26.12%) as compared to Raj-171 (23.83%), MPMH-17 (20.91%) and HHB-67 (13.29%) improved varieties. The maximum per cent disease severity was found in crops grown in clay soil (22.30%) followed by loamy (21.25%) and sandy (20.82%) and other types of soil whereas results in crops grown in different system showed that the maximum disease severity (%) was found in mustard-based cropping pattern (23.92%) followed by wheat-based cropping pattern (20.56%) and chickpea based cropping pattern (17.70%). Results also indicated that the disease severity was maximum in flood irrigation method (22.38%) followed by rainfed (21.49%) and sprinkler (19.94%) irrigation method. Pearl millet grown after wheat

and mustard crop in sandy loam soil in Sri Ganganagar, Hanumangarh and Alwar under irrigated conditions was more prone to *Bipolaris setariae*. The pearl millet was more conducive to infection of *B. setariae* at panicle emergence and flowering stage in the month of September to October when, temperature start to declining.

Keywords: *Bipolaris setariae*, Incidence, Panicle emergence, Severity, Susceptible.

Evaluate the Effective Weed Control Method to Manage Weed Flora in Groundnut (*Arachis hypogaea* L.) Cultivation

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ABSTRACT

Groundnut (*Arachis hypogaea* L.) is an annual legume crop, belongs to family Leguminosae which are largely grown during *Summer* and *Kharif* season. Field experiment was carried out during *kharif* season 2024-25 at School of Agriculture and Veterinary Science, Shridhar University, Pilani, Jhunjhunu, Rajasthan. This study aimed to investigate the comparative efficacy of cultural, chemical and integrated weed control approaches in groundnut (*Arachis hypogaea* L.). The findings revealed that in weed flora, *Digera arvensis*, *Portulaca oleracea*, *Aclaypha indica* were dicot weeds and *Cynodon dactylon*, *Cyperus rotundus*, *Echinochloa crusgalli*, *Elucine indica* were monocot weeds. At harvest, the least weed density was recorded in imazethapyr @ 75 g a.i./ha (post-emergence) + straw mulch (5 t/ha) (13.28), the least weed dry weight was recorded imazethapyr @ 75 g a.i./ha (post-emergence) + straw mulch (5 t/ha) (70.75gm), the highest weed control efficiency (WCE) was recorded in imazethapyr @ 75 g a.i./ha (post-emergence) + straw mulch (5 t/ha) (88.45%), highest weed index was recorded in among the herbicides, pre-emergence application of pendimethalin @ 1.0 kg a.i./ha (29.68%), post-emergence application of imazethapyr @ 75 g a.i./ha at 20 DAS (27.67%) as compare to weedy check which were significantly inferior in different observations. It is concluded that herbicidal treatments of imazethapyr @ 75 g a.i./ha (post emergence application) + straw mulch (5 t/ha) which was found effective method to manage weeds and enhance the yield in groundnut.

Keywords: Groundnut, herbicide, Integrated Weed Control, post emergence.

Role of Fertility and Sulphur Levels on Productivity of Coriander (*Coriandrum sativum* L.)

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ABSTRACT

A field experiment was conducted at Research Farm of Agricultural Research Station, Ummedganj, Kota during *rabi* season of 2021-22 and 2022-23 on clay loam soil to study the Effect of Varying Fertility and Sulphur Levels on Productivity and Quality of Coriander (*Coriandrum sativum* L.) and their Residual Influence on Succeeding *Zaid* Mungbean [*Vigna radiata* (L.) Wilczek] which was laid out in split plot design with three replications. The experiment comprised of 28 treatment combinations with seven levels of fertility and four levels of sulphur. In this experiment application of different levels of fertility and sulphur were applied to the coriander. Result showed pooled mean basis that application of 125% RDF + foliar spray of NPK (19:19:19) 0.5% at pre flowering and umbellate formation had significant influenced on plant height at harvest (96.45 cm), dry matter accumulation at harvest (194.70 g/m row length), crop growth rate at 60-80 DAS (0.974 g/m²/day), number of primary branches/plant

(8.01) and chlorophyll content (2.77 mg/g) and yield attributes and yields viz., number of umbels/plant (30.68), number of umbellate/umbel (5.87), number of seeds/umbel (29.87), test weight (12.61 g), seed yield (1804 kg/ha) and straw yield (2799 kg/ha) of coriander. Which was statistically at par with 100% RDF + foliar spray (19:19:19) @ 0.5% at pre flowering and umbellate formation and 125% RDF over control and remaining treatments. Among the sulphur levels application of sulphur 60 kg/ha enhanced growth parameters viz., plant height at harvest (96.01 cm), dry matter accumulation at harvest (197.64 g/m row length), crop growth rate (0.977 g/m²/day), number of primary branches/plant (8.02) and chlorophyll content (2.75 mg/g) and yield attributes and yields viz., number of umbels/plant (30.80), number of umbellate/umbel (5.84), number of seeds/umbel (30.43), test weight (12.58 g), seed yield (1815 kg/ha) and straw yield (2815 kg/ha), of coriander. Which was at par with sulphur 40 kg/ha as compared to control and sulphur 20 kg/ha.

Keywords: Fertility, Sulphur, Coriander, Productivity and RDF.

Nutrient response and yield of mungbean in response to zinc and iron through agronomic mechanism of biofortification

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ABSTRACT

A field experiment was conducted at College of Agriculture, Agriculture University, Jodhpur in kharif season during 2020 and 2021 to study the effect of agronomic biofortification of zinc and iron on yield and nutrient response of mungbean [*Vigna radiata* (L.) Wilczek] varieties. The experiment was laid out in a split plot design, comprised with two varieties namely GM-7 and MH-421 and three treatments of foliar spray of iron (Fe) and urea in main-plots and four treatments included seed inoculation by zinc solubilizing bacteria with soil application of zinc (Zn) in combinations were assigned to sub-plots. In this way, the experiment had twenty four treatment combinations were replicated thrice. Mung bean variety 'MH-421' had performed prominently with respect to yield and nutrient response. Biofortified treatment of iron with urea spray and zinc significantly higher seed yield, ABR, iron and zinc response were recorded under treatment foliar spray of 0.5% Fe + 2% urea at flower initiation and pod formation stages and seed inoculation with ZSB + soil application of higher dose of zinc sulphate i.e. ZSB (SI) + 25 kg ZnSO₄ /ha, which remained at par with foliar spray of 0.5% Fe + 2% urea at flower initiation stage and ZSB (SI) + 20 kg ZnSO₄ /ha at 25, 50 DAS and at harvest stage of mungbean, respectively.

Keywords: Foliar spray, iron sulphate, zinc sulphate, zinc solubilizing bacteria, yield, ABR

Effects of nutrient management on growth and yield of barley (*Hordeum vulgare* L.) under central plateau and hills agro ecological region

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ABSTRACT

A field experiment was conducted during the winter (*rabi*) seasons of 2017–18 and 2018–19 at the Rajasthan College of Agriculture, MPUA&T, Udaipur, Rajasthan, to find out best integrated nutrient management strategy in barley (*Hordeum vulgare* L.). The experiment was laid out in a randomized block design (factorial), comprising combinations of 6 fertility levels [75% recommended dose of

fertilizers (RDF), (45 kg N and 22.5 kg P₂O₅) 100% RDF (60 kg N and 30 kg P₂O₅); 125% RDF (75 kg N and 37.5 P₂O₅); 75% RDF + farmyard manure (FYM) 5 t/ha; 100% RDF + FYM 5 t/ha; and 125% RDF + FYM 5 t/ha, and 4 liquid bioinoculants, viz. *Azotobacter*, phosphate solubilizing bacteria (PSB), *Azotobacter* + PSB and *Azotobacter* + *Azospirillum* + phosphates solubilizer + PGPR (plant-growth promoting rhizobacteria) at the rate 5 ml/kg seed. The results indicated that, application of 125% RDF in conjunction with FYM 5 t/ha had significant effect on yield attributes, viz. effective tillers (45.36), ear length (9.37 cm), ear weight (3.22g), grains/ear (54.49), grain weight/ear (2.70 g), straw weight/ear (0.52 g), filled spikelet/ear (54.47), least number of unfilled spikelet/ear (3.24) and test weight (49.92 g), and grain (5.20 t/ha), straw (7.79 t/ha) and biological yield (12.99 t/ha) which was at par with 100% RDF + FYM 5 t/ha. However, both these fertility levels significantly increased the grain weight/ear over application of 75% RDF + FYM 5 t/ha, 125% RDF, 100% RDF and 75% RDF during both the years. The barley crop under the influence of conjoint inoculation with liquid bio-fertilizers, consisting combination of *Azotobacter* + *Azospirillum* + phosphates solubilizer + plant growth-promoting rhizobacteria (PGPR) recorded significantly higher yield attributes, grain (5.12 t/ha), straw (7.57 t/ha) and biological yields (12.69 t/ha) and was found at par with inoculation of *Azotobacter* + PSB inoculation.

Keywords: *Azotobacter*, *Azospirillum*, Phosphates solubilizer, PGPR.

Driving Resource Use Efficiency and Profitability in Fenugreek (*Trigonella foenum-graecum* L.) Cultivation: An Economic Assessment and Constraint Analysis in Bikaner District of Rajasthan
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ABSTRACT

The present study assesses the cost of cultivation, resource use efficiency, and prevailing constraints in fenugreek production among farmers of Bikaner district, Rajasthan, a major fenugreek-producing region in India. Using primary data collected from 30 growers via multistage sampling, comprehensive cost structures and returns were analysed across different farm sizes. Results revealed an overall average cost of cultivation ₹37,380.04 per hectare, with gross income reaching ₹61,563.33 and net income at ₹24,267.3 per hectare. The benefit-cost ratio of 1.70 demonstrates substantial profitability for fenugreek growers. Resource use efficiency analysis indicated underutilization of key inputs such as machine labour and fertilizers, suggesting potential for productivity enhancement through optimal input allocation, while irrigation was identified as overused. The study highlights significant impediments, including lack of improved seed varieties, financial constraints, limited disease management knowledge, and inadequate marketing infrastructure—especially the absence of Minimum Support Price (MSP) and processing facilities. Addressing these constraints, developing resilient varieties, improving farmer awareness, and fostering postharvest infrastructure are essential for sustainable growth. Future research should focus on technological adoption, climate resilience, and value addition to empower fenugreek farmers and bolster regional Agri-economics.

Keywords: Cost of cultivation, resource use efficiency, profitability, constraints, input allocation.

Climate Change and Its Impact on Agriculture: A Synthesis of Evidence and Adaptation Strategies**Vandana Kumari¹ and Vikram Yogi²**¹ *Department of Agricultural Economics, Swami Keshwanand Rajasthan Agricultural University, Bikaner, Rajasthan (334006) INDIA*² *Department of Agricultural Economics, Swami Keshwanand Rajasthan Agricultural University, Bikaner, Rajasthan (334006) INDIA***ABSTRACT**

Climate change is emerging as a critical economic and environmental challenge for agriculture, particularly in developing countries where over 58% of the population depends on farming for livelihood. With agriculture contributing nearly 18% to India's Gross Value Added (GVA), its vulnerability to climate variability poses serious implications for food security and rural income stability. Rising temperatures, irregular monsoons, and frequent extreme weather events are already disrupting agricultural output, especially in rainfed and drought-prone regions like Rajasthan. Studies show that a 1°C rise in temperature could reduce yields of major staples by 3%–7%, particularly affecting wheat and rice. Between 2015 and 2020, India experienced a decline in average annual cereal yield growth from 1.9% to 0.9%, attributed in part to climate-induced stress. Rainfall variability has increased by 6% in the last two decades, leading to crop failures, reduced germination rates, and lower input-use efficiency. The estimated annual loss in Indian agriculture due to climate change is around ₹5,600 crore, disproportionately affecting smallholder farmers with less than 2 hectares of land. The economic impact extends to increased input costs, falling profit margins, and higher credit dependency. Women farmers, constituting 33% of India's agricultural workforce, face heightened vulnerability due to limited access to irrigation, credit, and extension services. To mitigate these risks, climate-resilient strategies are being promoted, such as micro-irrigation (adopted on 14.5 million hectares), drought-resistant seeds, integrated farming systems, and mobile-based weather advisories. However, scaling these requires significant policy support, targeted subsidies, and investments in rural infrastructure and institutional capacity. This study highlights the urgent need for an inclusive, economically sound, and innovation-driven approach to build agricultural resilience—ensuring long-term sustainability, income security, and food system stability in the face of accelerating climate change.

Keywords: Climate Change, Agricultural Vulnerability, Food Security, Climate-Resilient Agriculture, Sustainable Farming.

Intelligent packaging**Dikhasmita Bezbarua*, Supriya Langthasa****ABSTRACT**

Intelligent packaging is an emerging technology that uses the communication function of the package to facilitate decision making to achieve the benefits of enhanced food quality and safety. The trend towards sustainability, improved product safety, and high-quality standards are important in all areas of life sciences. In order to satisfy these requirements, intelligent packaging is used in the food sector. These systems can monitor permanently the quality status of a product and share the information with the customer. Hence, food waste can be reduced and customer satisfaction can be optimized. Depending on the product, different types of intelligent packaging technologies are used. The main components of an intelligent packaging are data carriers, indicators, and sensors. Indicators are either placed in the headspace of the package or attached to the lid—oxygen leak indicators, carbon dioxide, microbial, and pathogen indicators.

Time temperature indicator have also been applied to assess the pasteurization and sterilization process. Cameron and Talasila (1995) investigated the detection of respiration changes in packaged produce by measuring the ethanol in the headspace of the packages, using alcohol oxidase and peroxidase. Overall, intelligent packaging can ensure food quality and safety in the food industry, however there are still some concerns over this emerging technology including high cost and legal aspects, and thus future work should be performed to overcome these problems for further promoting its applications in the food industry.

Keywords: Packing, Pathogen indicators, Pasteurization, Sterilization, Alcohol oxidase

Winged Bean [*Psophocarpus Tetragonolobus* (L.) Dc.] A Multipurpose Crop for Addressing Malnutrition and Promoting Food Security

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ABSTRACT

Winged bean (*Psophocarpus tetragonolobus* (L.) DC.) is an underutilized tropical legume recognized as a “superfood crop” owing to its exceptional nutritional quality, multipurpose use, and contribution to food and nutritional security. All parts of the plant are edible—the tender pods are consumed as vegetables, seeds contain 30–40% protein with a balanced amino acid profile comparable to soybean, leaves are rich in vitamins and minerals, and tuberous roots supply carbohydrates with appreciable protein content. This unique trait makes winged bean highly beneficial in combating protein-energy malnutrition.

Genetically, the crop is still less explored, with limited genomic resources and narrow breeding efforts restricting its improvement. Winged bean exhibits considerable variability in pod length, seed yield, number of seed per pod, root length, protein content, and biomass traits, offering scope for selection and genetic enhancement. The application of modern tools such as molecular markers, transcriptomics, markers assisted selection (MAS), markers assisted back cross breeding (MABC), and genomic-assisted breeding could accelerate the development of high-yielding, early-maturing, and stress-resilient varieties. Its strong nitrogen-fixing ability (up to 200 kg N/ha/year) also supports sustainable agriculture by improving soil fertility. Despite its potential, winged bean remains neglected in mainstream crop improvement programs. Strengthening genetic studies, germplasm conservation, and breeding strategies could transform it into a climate-smart, protein-rich crop, significantly contributing to nutritional security and agricultural diversification in tropical regions.

Keywords: Nutritional Security, Superfood, Markers Assisted Selection, Sustainable Agriculture, Protein, Transcriptomics.

Innovative Approaches in Eri Silkworm Byproduct Utilization towards Zero-waste Sericulture **Archita Bhagawati and Dr. Ratul Kumar Borah**

ABSTRACT

The Eri Silkworm (*Samia ricini*) is an important species of silkworm, often known as “Ahimsa Silk.” It holds significant cultural and economic value in regions where sericulture is a traditional livelihood practice. As it is a cruelty-free silk and the moth emerges naturally without stifling, Eri silk is preferred by peace lovers. It is reared on primary host plants Castor (*Ricinus communis*) and *Ailanthus* spp., and on the secondary host plant Tapioca (*Manihot utilissima*).

Beyond silk production, eri culture generates valuable byproducts from host plant cultivation to cocoon harvesting. The silkworm pupa, rich in protein, is consumed as a delicacy in Japan, China, and North

East India. It can also be processed into pupal oil for cosmetic production. Castor plants not only provide foliage but also yield non-edible castor oil, which can be used in biodiesel production. Tapioca tubers are used for edible chips and flour, while the leaves and bark of the *Ailanthus* tree serve as traditional medicine. Silkworm larval excreta, exuviae, and discarded leaves can further be used to prepare compost or manure.

This review highlights how effective utilization of Eri silkworm byproducts and host plants can generate additional income for sericulture farmers while reducing waste, thereby promoting a zero-waste Eri culture model.

Keywords: Eri silkworm, Tapioca, Ahimsa silk, Zero waste

Proteomics and its application in Crop improvement

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ABSTRACT

Proteomics is the study of proteins and their interactions in a cell. Within the wide field of functional omics, proteomics has become a useful tool and the emphasis is shifting from genomics to the protein compliment of the human organism. Because proteome reflects more accurately on the dynamic state of a cell, tissue, or organism, much is expected from proteomics to yield better disease markers for diagnosis and therapy monitoring. Hence the present review was to review proteomics technologies and their applications for crop improvement. The advent of proteomics technologies for global detection and quantitation of proteins creates new opportunities and challenges for those seeking to gain greater understanding of diseases. High- throughput proteomics technologies combining with advanced bioinformatics are extensively used to identify molecular signatures of diseases based on protein pathways and signalling cascades. Mass spectrometry plays a vital role in proteomics and has become an indispensable tool for molecular and cellular biology. However, future developments may enable faster and more sensitive proteomics studies and Proteomics alone cannot provide all the information required for understanding cellular processes. Therefore, complementary approaches in genomics, metabolomics and bioinformatics will have to be used together with proteomics to permits a more holistic view of biological systems and their alterations in disease, so that the maximum benefit can be realized.

Keywords: Bioinformatics, mass spectrometry, proteomics, two-dimensional electrophoresis.

Genetic Importance and Improvement Prospects of Black Rice (*Oryza Sativa* L.) for Nutritional Security

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ABSTRACT

Black rice (*Oryza sativa* L.), often termed “forbidden rice,” is a nutritionally superior and genetically distinct rice type valued for its high anthocyanin content, antioxidants, vitamins, and minerals. The unique black or purple pericarp is controlled primarily by the Kala4 gene, along with other regulatory genes influencing anthocyanin biosynthesis. This genetic makeup not only contributes to its health-promoting properties but also provides an excellent model for studying secondary metabolite pathways in cereals.

From a crop improvement perspective, black rice represents a valuable genetic resource for breeding programs aimed at enhancing nutritional quality, stress tolerance, and grain diversity. Considerable

variability exists among black rice landraces for traits such as grain yield, plant height, maturity duration, and antioxidant capacity, offering scope for selection and hybridization. The use of molecular markers, QTL mapping, and genomic tools has enabled identification of key loci associated with pigmentation, yield components, and abiotic stress tolerance. Recent advances in marker-assisted selection, transcriptomics, and genome editing technologies such as CRISPR/Cas9 open new avenues for targeted improvement of black rice.

Keywords: Hybridization, Marker-assisted Selection, Transcriptomics, Genome editing, QTL mapping.

Effects of Purple Seed Stain on Seed germination and Seedling Vigor Index in Soybean

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ABSTRACT

Purple seed stain disease, caused by (*Cercospora kukuchii*), is a major concern in soybean (*Glycine max* (L.)) In Maharashtra, due to its effects on seed quality, reducing soybean seed quality, seed grade and potential market price at elevators. Therefore, investigating the effects of purple seed stain (PSS) on seed quality (seed germination and seedling vigor index). The objective of this study was to investigate the effects of PSS on seed harvest index, seed germination, seedling vigor index. A field experiment was initiated at Experimental farm of Seed Technology Research Unit during *kharif* 2022. The results showed that non-infected seed (control) had higher seed germination percent and seedling vigor index as compared to infected seed. Seed germination was 32 % greater and seedling vigor index was 59 % greater in non-infected seed. The research showed that PSS impacted seed health and seed quality (seed germination and seedling vigor index). Purple stained seed should be avoided when planting and should be managed properly as low germination is a potential risk. Planting population should be adjusted accordingly due to lack of germination and vigor if PSS is present.

Attitude of Postgraduate Scholars towards Higher Agriculture Education in Rajasthan

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ABSTRACT

The National Agricultural Research System in India is supported by agricultural higher education. The cornerstone for need-based human resources and high-quality education is a strong network of higher education institutions. The study was carried out selecting a random sample of 180 postgraduate scholars studying in first- and second-year M.Sc. (Agri.) at Agriculture Universities in Rajasthan. The overall distribution of attitude shows that majority of the postgraduate scholars (65.56 %) of agriculture universities in Rajasthan belonged to favorable category of attitude, followed by 21.66 per cent of them with most favorable category and rest 12.78 per cent belongs to the less favorable category of attitude towards higher agriculture education.

Keywords: Attitude, Higher Agriculture Education, Postgraduate scholar, Rajasthan and Organic farming

Shaping Learning Environments: The Role of Sustainable Wall Colors in Educational Institutions
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ABSTRACT

The physical environment of educational institutions significantly influences student learning, well-being, and overall academic performance. Among the many design elements, wall colors play a vital role in shaping mood, focus, and creativity while also reflecting an institution's commitment to sustainability. This study examines the dual impact of wall colors and sustainable painting practices in educational settings, emphasizing their psychological effects and environmental implications. Drawing on principles of color psychology, the research highlights how specific hues blue, green, yellow, and orange can foster calmness, focus, creativity, and enthusiasm when applied thoughtfully within classrooms and learning spaces. In parallel, the study explores eco-friendly painting solutions, such as low-VOC, plant-based, water-based, and heat-reflective paints, which contribute to healthier indoor air quality and reduce the carbon footprint of institutions. A mixed-methods research approach was employed, combining survey data from 100 students and teachers with in-depth interviews of 20 educators and administrators across various institutions. The findings revealed a strong preference for green (40%) and blue (30%) as calming and focus-enhancing colors, followed by yellow (20%) and orange (10%) for their stimulating and motivational properties. Furthermore, 80% of participants expressed a preference for eco-friendly paints, while 75% emphasized sustainable practices such as waste minimization and recycling. Qualitative insights from administrators underscored the importance of aligning wall color choices with sustainable practices to create a positive school culture and instill environmental values in students. The study concludes that the integration of sustainable wall colors in educational institutions not only enhances student well-being and academic performance but also supports institutional sustainability goals. Recommendations include adopting low-VOC paints, strategically selecting color palettes based on psychological effects, and implementing sustainable painting practices. Future research should investigate long-term outcomes and develop comprehensive guidelines for sustainable color use in educational settings.

Keywords: *Sustainable design; Educational institutions; Wall colors; Color psychology; Eco-friendly paints*

Economics and Value Chain Status of Finger Millet in Ranchi District, Jharkhand

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ABSTRACT

The present study was conducted on economics and value chain status of finger millet in Ranchi district of Jharkhand. The study was conducted pertaining to the agricultural year 2024-2025 with 120 finger millet farmers. The purposively simple stratified random sampling technique was adopted for the selection of total 120 farmers and further divided into three categories viz; marginal (below 1 ha), small (1.01 - 2.00 ha), semi-medium (2.01 - 4.00 ha) based on land size holding. Accordingly maximum number of respondents were in the category of marginal farms (72.50 per cent). Compound growth rate of area, production and productivity of finger millet for last 20 (2001 to 2020) years' time series data of both Jharkhand state as well as Ranchi district were calculated Compound Growth Rate for whole period recorded negative for area, positive for production and productivity in the state but all were non-significant during period-I (2001 to 2011) similarly, productivity of finger millet had shown significant

growth period-III (2001 to 2020). The study reveals the total cost of cultivation per ha incurred by marginal farmers recorded lowest of Rs 6234.26/-, followed by small farms and it was highest for semi-medium farms and it comes to B: C ratio recorded highest for semi-medium farms 1.50 followed by marginal farms 1.40 and lowest by small farms 1.40; lack of irrigation facilities was found to be the major constraints, followed by high cost of production, incidence of pests and disease, high weed infestation, high labour charge, damaging crop by wild animal non-availability of labour, lack of knowledge, high transportation charges, low market price. Department of Agricultural Economics School of Agricultural Sciences Nagaland University, Medziphema Campus-797 106 Nagaland

Keywords: *Finger millet, trends, value addition, economics, constraints*

A thematic review for bridging the gender gaps via gender sensitization towards climate change in Indian agriculture

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ABSTRACT

Gender which is defined as a social construct showcases the social dynamics & relational aspects between men and women which leads to several differential position and importance in the society. Gender sensitization serves as a transformative tool to reshape entrenched societal norms that define and perpetuate gender inequalities, particularly within the agrarian and climate-vulnerable landscape of India. In India, where atmospheric aberrations are occurring rapidly, climate change poses a risk of exacerbating existing health inequalities based on gender. Incorporating a gender-focused approach into current climate, development, and disaster-risk reduction policies can help mitigate adverse health impacts. Addressing climate risks necessitates coordination across various sectors, enhancements in data collection, tracking of gender-specific objectives, and fair involvement of all stakeholders. Despite women comprising a significant proportion of the agricultural workforce, their participation is often undermined by systemic gender biases, limited access to resources, decision-making exclusion, and information asymmetry. This review paper explores how gender sensitization intersects with climate change challenges, highlighting the disproportionate impacts on women and the urgent need to integrate gender perspectives into policy-making, adaptation strategies, and community engagement. Through a critical analysis of secondary literature and case studies, the study reveals that climate-smart, gender-inclusive interventions—such as access to technology, land ownership rights, and capacity-building—can empower women, enhance farm sustainability, and foster climate resilience. It underscores the importance of gender-responsive policies that prioritize inclusivity, equity, and active female participation across all levels—from grassroots to governance. Ultimately, gender sensitization emerges not just as a corrective measure, but as a catalyst for sustainable development and climate justice.

Keywords: Climate change, Gender, Gender gaps, Gender sensitization, Indian agriculture