

5th International Conference Climate Change and Its Impact (CCI-2023)

June 9-11, 2023

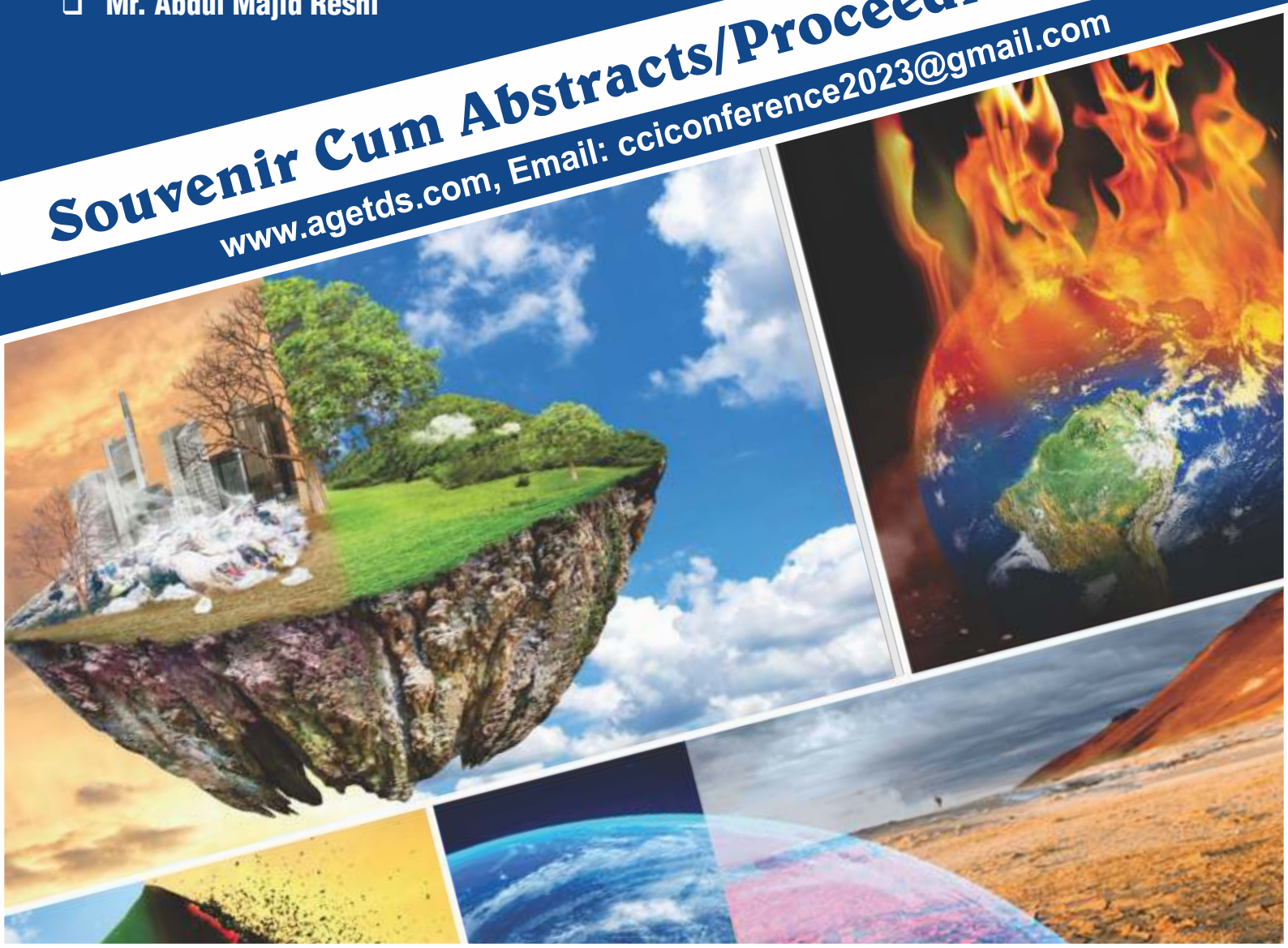
EDITORS

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|---|---|
| <input type="checkbox"/> Dr. Wajid Hasan | <input type="checkbox"/> Dr. Kota Chakrapani |
| <input type="checkbox"/> Dr. F. A. Khan | <input type="checkbox"/> Dr. C. P. Singh |
| <input type="checkbox"/> Dr. Gururaj Sunkad | <input type="checkbox"/> Dr. Nareshkumar E. Jayewar |
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| <input type="checkbox"/> Mr. Abdul Majid Reshi | |

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Climate Change and Its Impact

Editors:

Dr. Wajid Hasan, Krishi Vigyan Kendra, Jahanabad, BAU, Sabour, Bihar, India
Dr. Kota Chakrapani, College of Agriculture, CAU, Imphal, Manipur, India
Dr. F. A. Khan, Faculty of Horticulture, SKUAST, Srinagar (J&K), India
Dr. Gururaj Sunkad, University of Agricultural Sciences, Raichur, Karnataka, India
Dr. C.P. Singh, Agricultural and Environmental Technology Development Society, U. S. Nagar, India
Dr. Mirza Hasanuzzaman, Sher-e-Bangla Agril. University, Bangladesh.
Dr. Nareshkumar E. Jayewar, Agriculture Technical School, Nanded, M.H., India
Mr. Atul Kumar, Bihar Agricultural University, Sabour, India
Dr. Md. Minnatullah, Sugarcane Research Institute, RPCAU, Pusa, Bihar, India
Dr. Altaf Kuntoji, University of Agricultural Sciences, Raichur, Karnataka, India
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Dr. Karan Singh Dhami, Mid-West University, Nepal
Dr. Reena Roy, NIMS, University, Jaipur, Rajasthan, India
Mr. Abdul Majid Reshi, SKUAST-K, Shalimar

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Professor Dr. Md. Shahidur Rashid Bhuiyan
Vice-Chancellor
Sher-e-Bangla Agricultural University
Dhaka-1207, Bangladesh
&
Patron: CCI-2023
E-Mail: vc@sau.edu.bd
Tel: +0244814051



Message from Patron

It gives me immense pleasure to know that the Agricultural & Environmental Technology Development Society (AETDS), U.S. Nagar, UK, India is going to organize the *5th International Conference on Climate Change and its Impact (CCI-2023)* in collaboration with Sher-e-Bangla Agricultural University, Dhaka-1207 along with other reputed organizations.

The demand for agricultural production will be increased to feed the fast-growing human population. However, climate change adversely affects different forms of agriculture and causes disorders in ecosystem functioning. However, some adaptive strategies showed beneficial outcomes for some crops under moderate climatic conditions. Therefore, developing different crop varieties with climate resilience can provide better food sources to alleviate poverty, especially in Asia and Africa. Moreover, the release of greenhouse gases has significantly raised and predicted an average rise of 0.8 °C in annual temperature, causing global warming. It is estimated that the world population will be around 9 billion by 2030. At the same time, it would be difficult to deal with changing climate for the provision of food resources. Therefore, it is necessary to develop resilient crops against environmental conditions. In addition, the integration of molecular plant breeding and genome editing, as well as engineering approaches, could assist in developing climate-resilient crops.

I am delighted to see that this conference has been designed to focus on various scientific tracks covering major areas of research on Climate Change: Challenges and Mitigation. This Conference anticipates bringing together the global scientific community, policymakers, administrators, industry representatives, and other stakeholders for real brainstorming on these glaring issues related to the current crisis of global agriculture.

I am thankful to the organizers for including Sher-e-Bangla Agricultural University as one of the co-organizers. I would like to thank the organizing institutes of this conference and thank the people whose dedicated efforts and creative plans will make the conference successful. Finally, I wish the grand success of the 5th International Conference on Climate Change and its Impact (CCI-2023).

Dated: 09-06-2023

(Md. Shahidur Rashid Bhuiyan)



Prof. Nazir A. Ganai
Vice-Chancellor

Message

Climate change is more than obvious now and we are increasingly recognising the potential implications in the form of extreme weather events, declining crop productivity and shifting of regional crop suitabilities. The worst-case scenario predictions of climate models are expected to significantly dent our efforts for ensuring sustainable food supplies for about 9 billion people by 2050 and achieve broader targets of UN SDG's. There is a global appreciation of the fact that climate change will be the greatest challenge that we have to offset in contemporary times and a holistic approach for sustaining food systems and ecosystem services will be needed. The anthropogenic driven changes in climate will result in rise in global surface temperatures, changes precipitation patterns, increased CO₂ in atmosphere as well as overall changes in earths broader climate patterns.



Agriculture is a major contributor to climate change and a major sufferer of its impacts also. Significant amounts of nitrous oxide and methane are emitted by agricultural soils. Animals, rice soils and garbage dumps emit significant amounts of methane. The COP27 estimates predict about 3.4 million deaths per year by the end of this century by climate change, with India alone accounting for an estimated 1 million related deaths. National Innovations in Climate Resilient Agriculture (NICRA) has projected that the yield of rainfed rice, irrigated rice, wheat and maize are projected to reduce by 2.5%, 7%, 6-25% and 18-23%, between 2050-2080, respectively. The impacts assessment studies of fragile areas like Kashmir Himalayas are highly alarming with limiting adaptive capacities and climate investment.

Any deliberation on climate change, its impacts and strategies for its mitigation and adaptation is timely and worth the investment of time and effort. There is a need to polarise public opinion and generate awareness and resolve to address various policy and research issues of climate change and to evolve a tangible set of climate action strategies that incorporates technology, policy and political support for creating a sustainable planet habitat. In this context the international conference on Climate Change and Its Impact (CCI) is a timely effort by organisers to converge global expertise and opinion for a fruitful outcome. I congratulate the organisers for organising this important and timely conference and believe that the deliberations of the conference shall be fruitful in furthering our appreciation of climate change and sustainability and evolve a science-based road map and policy recommendation for a sustainable future.

(Nazir Ahmad Ganai)

Place: Shalimar, Srinagar

Dated: 25.05.2023



Mid-West University Office of the Vice-Chancellor

Birendranagar, Surkhet, Nepal

Ref.No.:



Date: 24 May 2023

Message from the Vice-Chancellor

It is my great pleasure to issue a message that Agricultural & Environmental Technology Development Society(AETDS), U.S., Nagar, UK, India is organizing the 5th International Conference on "Climate Change and its Impact (CCI-2023)" in collaboration with Sher-e-Kashmir University of Agricultural Sciences and Technology (SKUAST-K), Srinagar, J & K, India; University of Agricultural Sciences, Raichur Karnataka, India; Vasantnao Naik Marathwada Krishi Vidyapeeth, Parbhani M.S, India; Mid-West University, Surkhet, Nepal and Sher-e-Bangla Agricultural University, Dhaka, Bangladesh at Sher-e-Kashmir University of Agricultural Sciences and Technology (SKUAST-K), Srinagar, J & K, India during 9-11 June, 2023.

The conference topic "Climate Change and its Impact" is one of the urgent and serious concerns for topic of discussion globally. Climate change has become the biggest challenge to the mankind creating huge impact on socio-economic development of any country. The international conference is the best platform where researchers, professionals and students from different institutions and Universities nationally and internationally come together to discuss such issues and related research outcomes for effective solutions to the issues. This platform will also help to establish a good collaboration between universities and industrial firms to address the current world issues. I believe the sharing of the outcomes of researches, articles, ideas, innovations and experiences, of different expertise and researchers under different sub-themes will be a milestone for the solutions to ongoing challenging issues of climate change.

I congratulate the organizing committee of the conference for organizing the conference addressing the current world issues. I would like to thank distinguished keynote speakers, academicians, researchers and participants for their valuable knowledge sharing and submitting constructive papers and abstracts for this conference.

I wish the conference a grand success !

Prof. Dr. Nanda Bahadur Singh
Vice-Chancellor
Vice-Chancellor

UNIVERSITY OF AGRICULTURAL SCIENCES, RAICHUR

[ICAR, NAAC accredited and UG u/s 12(B) & 2(f) approved]

Dr. MHANUMTHAPPA

M.Sc.(Agri.), Ph.D., PGDAEM

Vice-Chancellor



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FOREWORD

More adverse impacts of climate change on agriculture are owing to increase in temperature, change in rainfall pattern, weather hazards, decline in soil and water quality, shifting dynamics of insects, diseases, soil flora and fauna, intrusion of sea water on land and biotic and abiotic stresses arising due to climatic extremes. There could be a few positive impacts of climate change on agriculture in some locations because of change in temperature and moisture regimes.

Greenhouse gas emissions that result from the extraction and burning of fossil fuels are major contributors to both climate change and air pollution. My policies and individual measures, such as transport, food and energy use choices, have the potential to reduce greenhouse gas emissions and produce major health co-benefits, particularly by abating air pollution.

To address the long-term negative impacts of climate change and short and medium term impacts of climatic variability on agriculture, there is a need for sustained research on increased adaptation and mitigation, capacity building, development activities, and bringing necessary changes in policies. These actions have to be accompanied by long-term sustained actions towards generation and strengthening of strategic knowledge system in key impact sectors like water, agriculture, energy, health, etc. by building human and institutional capacity.

Climate adaptation actions need to be implemented more intensely in synergistic way involving various programmes of central as well as state governments. The challenges in climate change will call for a paradigm shift in our research approach to harness the potential of the modern science, innovations in technology generations and diversity and enabling policy and investment support.

I wish all the delegates a wonderful time, fruitful stay and great scientific sessions for three days. I am sure deliberations of the international conference Climate Change and its Impact (CCI-2023) will have far reaching effect for developing the futuristic strategy to the farming community on climate change management.

I wish for commendable success of the conference.

Date: 29-05-2023

Place: Raichur

[**Mhanumthappa**]

Vice chancellor



VASANTRAO NAIK MARATHWADA KRISHI VIDYAPEETH
Parbhani - 431 402 (Maharashtra State) INDIA

Dr. Indra Mani
Ph.D. (Agril. Engg.)
Vice-Chancellor

Phone : 02452-223002 (O), 02452-223003 (R)
FAX : 02452-223582
E-mail : vcvmkv@gmail.com, vc@vnmkv.ac.in
Website : www.vnmkv.ac.in

MESSAGE

I extend my warmest greeting to all participants and attendees of 5th International Conference on "Climate Change and It's Impact (CCI 2023)" organised at Srinagar (J&K), India during 9th to 11th June 2023 by Agricultural & Environmental Technology Development Society (AETDS), Uttarakhand (India) in collaboration with our University Vasant Rao Naik Marathwada Krishi Vidyapeeth, Parbhani (M.S.). The other collaborators of the conference are Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir (SKUAST-K) Srinagar (J&K), University of Agricultural Sciences Raichur (Karnataka), Mid-West University, Surkhet, (Nepal), and Sher-e-Bangla Agricultural University, Dhaka (Bangladesh). This momentous event brings together scholars, researchers, policymakers, and industry experts from around the world, united by a shared concern for the profound effects of climate change on our agricultural systems.

Climate change is one of the most pressing challenges of our time, and its impact on agriculture is significant. Rising temperatures, changing precipitation patterns, and extreme weather events are affecting the very foundations of our food production systems. As we strive to feed a growing global population, it is imperative that we understand, adapt to, and mitigate the consequences of climate change to ensure sustainable and resilient agricultural practices.

This conference provides a platform for multidisciplinary dialogue and collaboration, where leading minds in climate science, agricultural engineering, agronomy, ecology, economics, and policy can come together to exchange knowledge, share innovative solutions, and foster meaningful partnerships. The range of topics covered in this conference is vast, encompassing the latest research findings, technological advancements, and best practices in the field. Through this conference, we seek to not only deepen our understanding of the complex interactions between climate change and agriculture but also identify practical strategies to address the challenges. By examining the nexus between climate change and food security, we can explore sustainable farming practices, resilient crop varieties, water management systems, and policy frameworks that promote adaptation and mitigation measures.

I extend my heartiest gratitude to the organizing committee, session chairs, keynote speakers, and all the contributors for their invaluable efforts in making this conference a resounding success. Together, we have the power to shape a more sustainable future for agriculture in the face of climate change. Let us seize this opportunity to forge new partnerships, spark innovative ideas, and drive meaningful change. I am confident that the outcomes of this conference will serve as a guiding light in our collective journey toward a resilient and climate-smart agriculture.

(Indra Mani)



From the Desk of the President AETDS, India

It's my indeed pleasure to welcome all the members to the 5th International conference on "Climate Change and its Impact (CCI, 2023)."

I am glad to convey my greetings as a president of AETDS and Chairperson of the International Conference which is going to be organized jointly by Agricultural & Environmental Technology Development Society (AETDS), U.S. Nagar, Uttarakhand, India, Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir (SKUAST-K) Srinagar, J&K., India, University of Agricultural Sciences Raichur, Karnataka, India, Mid-West University, Surkhet, Nepal, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, M.H. India and Sher-e-Bangla Agricultural University, Dhaka, Bangladesh in the fort month of June i.e., (9th June, 2023-11th June, 2023).

The Earth is rendering us all the resources to meet our daily needs, however the vigorous and indiscriminate usage of these resources is posing serious threat in the form of pollution and climate change respectively. Climate change consequences threaten the availability of our food and food production. Farmers are the firsthand to experience and impacts of climate change. It is high time for us to take necessary measures to mitigate these consequences which otherwise may risk the existence of our future generations.

The plenary sessions, interactive discussions on Climate Change are forth to derail the concrete outputs that can mitigate the disastrous consequences of climate change. The conference will also provide a platform for brighter minds to get together and ponder on many global issues and suggest innovative actions to meet the challenges. It is indeed a laudable endeavor on the part of AETDS, to organize the conference on such a large scale and provide a gathering of more than 1100 participants all around the globe. I hope all the participants will enjoy this academic fest. I wish the conference a grand success.

We're looking forward to an excellent meeting with renowned scientists, academicians, research scholars and youth from different countries around the world and sharing new and exciting results during the conference.

(Prof. C. P. Singh)

Conference Chairperson

President, AETDS, Society, U.S. Nagar, Uttarakhand, India

Former Prof. GBPUAT, Pantnagar, India



Professor Dr. Mirza Hasanuzzaman, Department of
Agronomy, Sher-e-Bangla Agricultural University,
Dhaka-1207

&

Associate Director: GIAFAS-2021

E-Mail: mhzsauag@yahoo.com

Cell: + 8801716587711



Message from Director

I would like to take the opportunity to express my profound joy at the event of the *5th International Conference on Climate Change and its Impact (CCI-2023)* jointly organized by the Agricultural & Environmental Technology Development Society (AETDS), U.S. Nagar, UK, India with Sher-e-Bangla Agricultural University, Dhaka-1207 along with other widely known organizations at Shri Guru Ram Rai University, Dehradun, U.K., India during 8-11 June 2023.

Climate change has been perceived as one of the biggest threats to socioeconomic development, the impact being more pronounced in the developing nations. The world's most climate change susceptible area is Southeast Asia. Agriculture is undoubtedly the backbone of this region. Thus, in brief, the fact is that the development of agriculture is the hard core of economic growth. This area has a relatively high population density, and a sizeable section of the population depends on agriculture for a living. In the future the trend of global warming will depend on human anthropogenic activities such as fossil fuel burning, deforestation, intensive farming and others that emit carbon dioxide and other greenhouse gases. Global crop production has been noticeably hampered in recent times and might be carried out for the next few decades as a consequence of climatic abnormalities such as irregularities in rainfall, increasing CO₂ concentration, and temperature. Integration of these factors affects normal growth duration, physiological responses of crops, brings pest outbreaks and unpredictable phenomena, and squeezes the available resources for agriculture, which increases the price of raw products for agro-industries. While the developed nations have trained their system to implement climate smart agricultural practices, the resource challenged farmers of the developing countries may not be able to implement many of the climate-resilient technologies at the cost of immediate profit. Environmental safety and sustainability are put as the last option by the resource-poor farmers. Thus, the small and marginal landholders continue to remain vulnerable to climate change and related disasters. Therefore, *5th International Conference on Climate Change and its Impact* for this year is of global preference today.

I hope the deliberations and sharing of the core ideas, experiences, creative imaginations, innovations, and formulas of different expertise under different sub-themes will be a milestone for the solutions to ongoing challenging issues regarding climate change and related actions in agriculture. Indeed, I believe that such kind of scholarly gatherings could play a vital role in making the world a better place and also making ready to tackle any difficult situations in the near future.

As a Director of the Conference, I am grateful to the researchers and academicians of national and international level and others who have offered their collaboration by submitting constructive papers and abstracts for this conference.

Finally, I wish the conference an eminent accomplishment in achieving its goal towards climate change adaptation thus enlightening global innovative in agricultural, forestry and applied sciences.

UNIVERSITY OF AGRICULTURAL SCIENCES, RAICHUR

[ICAR, NAAC accredited and UGC u/s 12(B) & 2(f) approved]

Dr. M.G. Patil

M.Sc. (Horti.), Ph.D

Director of Education



MESSAGE

Widespread improvements in the quality of life of many of the world's populations have gone hand-in-hand with increased demands on natural resources. The planet is struggling to keep up, with increases in the average global temperature and the frequency of extreme weather events transforming ecosystems around the world and threatening entire species of plants and animals. Forests are drying up, there is less rainfall and more fires, and the glaciers of both the North and South Poles are shrinking. The consequences of climate change affect all of us, but in order to react and adapt to it, we must first understand it.

The threat of climate change, manifested in the increase of extreme weather conditions such as, droughts, storms or floods, has been recognized as a global priority issue. Climate change is a sustainable development challenge, with broad impacts not only on the environment but also on economic and social development. The effects of climate change will vary among regions, and between different generations, income groups and occupations as well as between women and men. Due, in part, to their lower adaptive capacities, developing countries and people living in poverty are likely to experience significant impacts.

With a global and regional focus, the conference will cultivate powerful discussions amongst the academics, journalists, students, and social movements that are framing the future narrative of this issue in the context of climate justice. The discussions in the conference should make localbodies environment-friendly, saving water, saving energy, reducing waste, and e-wastes, adopting healthy lifestyles, adoption of natural farming, promotion of millets.

I appreciate this multi-disciplinary team for documenting overall status of climate change, impacts, programmes and policies related to agriculture in India. I am sure the conference on **Climate Change and its Impact (CCI-2023)** and its technical document will be useful for various stakeholders associated with the process of climate change adaptation in agriculture sector. In this regard, I wish the organizers, collaborators, delegates, scientific faculty, farmers and student community for the great success of the conference.

I wish the conference a great success.

Date: 29-05-2023

Place: Raichur

A handwritten signature in blue ink, appearing to read 'M.G. Patil'.

(M.G. Patil)
Director of Education



Vasantrya Naik Marathwada Krishi Vidyapeeth
Krishi Nagar, Basmat Road
Parbhani 431 402



E-mail	: reg_mau@rediffmail.com	Contact	: (02452) 229755
Web site	: www.vnmkv.ac.in	Fax	: (02452) 229755, 223582

date : 22-5-2023

Message

I am glad to know that 5th International Conference on "Climate Change and Its Impact (CCI 2023)" will be jointly organized by Sher-e-Kashmir University of Agricultural Sciences and Technology (SKUAST-K) Srinagar, J&K., India, Agricultural & Environmental Technology Development Society (AETDS), U.S. Nagar, Uttarakhand, India, University of Agricultural Sciences, Raichur, Karnataka, India, Vasantrya Naik Marathwada Krishi Vidyapeeth Parbhani, M.H., India; Sher-e-Bangla Agricultural University, Dhaka, Bangladesh and Mid-West University, Surkhet, Nepal at Sher-e-Kashmir University of Agricultural Sciences and Technology (SKUAST-K) Srinagar, J&K., India on June 9-11, 2023. Agriculture is severally affected in all the parts of world by changes in climatic. Climate variability and extreme weather conditions increase multiple stresses not only for crop plants but also for animals by endangering the habitats and the organisms themselves, the animals may not genetically evolve fast enough with the rate at which the climate is changing. So a effective strategy to meet the challenge is essential.

As the ecological relationship between environment, land, food, forestry and agriculture are highly diversified and complex, the interactive discussions by the scientists, researchers, academicians of national and international repute, professionals, research scholars, NGOs, social and extension workers, students, corporate, entrepreneurs, farmers, and others who are actively involved in Research and Development practices related to agricultural and applied sciences, on the issues such as Climate Change; Innovative Approach in Forestry, Agricultural and Allied Sciences; Agroforestry, Natural resource management, Food and Environmental Security ; Life Sciences, Biomedical Sciences, and Biotechnological aspects and AGRI and Animal Husbandry Start ups are the need of the day for the sustainable global growth as well as solution for global warming due to climatic change. Thus, the interactive sessions among the global scientists would definitely come to the conclusion to formulate some useful recommendations for the upliftment and growth of end users worldwide.

The creation of conference souvenir books is one of the key elements of scientific events. In regard to this, I am very happy to see that the Fifth International Conference's Abstract and Souvenir Book will be published. This collection will be very helpful to all of the attendees. I am confident that this Proceeding will be a true reflection of the organising committee's, workshop secretary's, and all other interested stakeholders' hard work and I would like to congratulate the entire team on this accomplishment.

I hope the conference will be a grand success and wish you all the best

Dr. Dhirajkumar R. Kadam
Registrar,
VNMKV, Parbhani



Prof. T.H. Masoodi
Director Research



MESSAGE

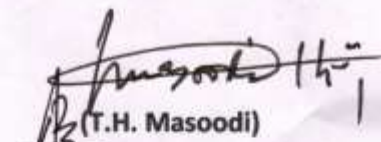
I am delighted that the Division of Basic Sciences and Humanities, Faculty of Horticulture, SKUAST-Kashmir in association with Agricultural & Environmental Technology Development Society (AETDS), U.K., India is organizing an International Conference on Climates change and Its Impact (CCI 2023) w.e.f. June 09 – 11, 2023 at SKUAST-K, Srinagar. It is a matter of pride that this conference is attracting academic and industrial participation both nationally and internationally. We at SKUAST-Kashmir aspire strongly to expand our research and innovation horizon, especially in the niche areas of agriculture, horticulture, animal husbandry and veterinary science, forestry, fisheries and sericulture. With such diverse and relatively large participation, I am sure that this conference will achieve its intent – to serve as an effective platform for the research community to learn, share and supplement each other's research, while keeping abreast of the latest trends in this arena. I also hope that this conference (ICED2008) will facilitate the establishment of international joint research programmes and become a forum for the exchange of research ideas. We invite you to use this conference to create new, or to strengthen existing, partnerships between the scientific community, publishers, policy makers and society.

I would also like to stress that in this era of rapid technological advancement, we as researchers will not survive without working in a coordination, supplementing and supporting each other's work. I believe that this conference would serve as an effective platform for academic staff, researchers and engineers to learn, network, share and to create an environment for intellectual exchanges which would benefit all parties. Lastly, may I plead that we should work hand-in-hand in our efforts to further enhance our research and development (R&D).

I hope that you will find the conference informative and enjoyable and take this opportunity to make new friends to expand your social contacts.

Have a great and enjoyable stay in Kashmir!

May 23, 2023
Srinagar


(T.H. Masoodi)
23/5/23



Mid-West University
Graduate School of Agriculture and Forestry
Bheriganga, Surkhet, Nepal



Ref. No.:

Date: 25/05/2023

Message from the Conference Associate Director

It is an honour to welcome you to 5th International Conference on "Climate Change and its Impact (CCI-2023)" jointly organised by Agricultural & Environmental Technology Development Society (AETDS), U.S. Nagar, UK, India; Sher-e-Kashmir University of Agricultural Sciences and Technology (SKUAST-K), Srinagar, J & K, India; University of Agricultural Sciences, Raichur Karnataka, India; Vasantnao Naik Marathwada Krishi Vidyapeeth, Parbhani M.S, India; Mid-West University, Surkhet, Nepal and Sher-e-Bangla Agricultural University, Dhaka, Bangladesh at Sher-e-Kashmir University of Agricultural Sciences and Technology (SKUAST-K), Srinagar, J & K, India during 9-11 June, 2023.

I strongly believe that this conference will be a good platform for the researchers, professionals and students from different institutions and Universities to discuss about their ideas, results and research findings related to ongoing challenging issue of climate change. This gathering will surely come up with fruitful solutions for this global issue thus making the world a better place in near future.

I would like to thank distinguished keynote speakers, reviewers, sponsors and participants for their interest and valuable knowledge sharing during the conference.

Wishing for the grand success of the conference.

Associate Prof. Dr. Karan Singh Dhama

COORDINATOR
Graduate School of Agriculture & Forestry
Mid-West University



Sher-e-Kashmir
University of Agricultural Sciences & Technology of Kashmir
DIRECTORATE OF EXTENSION
Shalimar Camus, Srinagar-190025 (J&K) INDIA
PHONE: 0194-2463460 Fax: 0194-2461317,
Email: deeskuastk@gmail.com

Prof. Dil Mohamad Makhdoomi
Director Extension

MESSAGE

The planet today is threatened by rising temperature and the biggest challenge confronting the humanity in the present era is the climate change induced by the rising temperature. According to the latest, the second part of sixth assessment report of Intergovernmental Panel on Climate Change (IPCC)- 'Climate Change 2023: Impacts, Adaptation and Vulnerability' released on February 28, 2022, there are observed impacts on climate change that are human-induced, which have accelerated recently with the advent of new extreme events in nature. This has led to widespread losses to both; nature and human society. The report had also found



that there is a more than 50% chance that global temperature rise will reach or surpass 1.5 degrees Celsius between 2021 and 2040 across studied scenarios and if emissions continue to remain high, the world may hit this threshold even sooner between 2018 and 2037. Back home, the report also came with a warning for India of dire consequences, if immediate and adequate mitigation or adoption efforts are not put in place. Agriculture is a sector which contributes to the climate change as well as is affected by it. It contributes to climate change mainly through emission of Green House Gases (GHGs) like Methane (CH₄), Carbon dioxide (CO₂) and Nitrous Oxide (NO). Methane gets produced during the microbial decomposition of organic matter under anaerobic conditions as in the case of Rice fields when kept submerged in water, the process of enteric fermentation in the ruminants also liberates methane in the atmosphere and the burning of crop residues is also a source of methane emission besides a source of pollution of the atmosphere. Fossil fuel use is the primary source of CO₂, another potent greenhouse gas. CO₂ also gets emitted from direct human induced impacts through deforestation, land clearing for agriculture and degradation of soils. The Nitrous Oxide gets released in the atmosphere by the use of nitrogenous fertilizers. Since 1970, the GHG emission from agriculture in India has increased by about 80 per cent and this is attributed to the increased use of chemical fertilizers and other inputs in agriculture.

Agriculture provides us the various adoption and mitigation strategies too. The adoption of various climate resilient technologies can help us to mitigate the adverse effects of rising temperature. Simple Resource Conservation Technologies (RCTs) can go a long way in minimizing the negative effects of GHGs in the atmosphere. Minimum or No Till agriculture with crop rotations with legumes reduces water requirements by up to 30 per cent as well as fixes atmospheric Nitrogen in the soil. Sowing across the slope reduces the erosion of soil and subsequent removal of nutrients from the soil thereby maintaining the fertility of the soil. The sloping sides can be planted with grass and trees. Mulching is another simple and one beneficial practice for conserving soil moisture. Technologies like Direct Seeded Rice (DSR) and System of Rice Intensification (SRI) that makes the least use of water should be promoted and adopted. Recycling of farm and animal waste into high quality organic manures also eliminates the risk arising out of use of synthetic fertilizers. Practices like Organic farming and Natural Farming have also the potential to restore the lost vigor of soil and its microbes. Rainwater harvesting also ensures that the excess of water is used judiciously. The most effective way of tackling the climate conundrum is to integrate adoption and mitigation strategies and I do believe that the three-day deliberations in the International Conference, 'Climate Change and Its Impact (CCI-2023)' will review the vulnerabilities, come up with relevant strategies to ensure that the global temperature do not breach 1.5 degrees Celsius limit and will also show all of us a roadmap to take so that the lives, biodiversity and ecosystems can be saved and restored.

I also congratulate the organizers of this international conference for having selected a topic which is most relevant in the present times and wish them a success for this grand event.

Director Extension
SKUAST-K, Shalimar



Prof. Shabir A. Wani
Dean

FACULTY OF HORTICULTURE

Sher-e-Kashmir
University of Agricultural Sciences & Technology of Kashmir,
Shalimar-Sgr, J&K, India-190025

MESSAGE



I am delighted to extend my greetings for the upcoming international conference on "Climate Change and Its Impact (CCI-2023) being organized by the Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir (SKUAST-K) in association with Agricultural & Environmental Technology Development Society (AETDS), U.K., India w.e.f. June 09 – 11, 2023 at SKUAST-K, Shalimar, Srinagar. This event shall give an opportunity to the agriculture fraternity, especially those who are associated with various areas of crop stress mitigation in context to climate change, to share their ideas and strategize a way forward for evolving an integrated approach for ensuring increased crop productivity and quality under changing climatic scenario. The Conference is a key base and favorable destination for horticulture-oriented business and research in India. The ground situation with our farmers though improving over last four decades has still a lot left to be achieved. Farmers' incomes are still dependent on a good rainfall for irrigation and climate change remains a challenge most of the time, especially for the horticulture crops that are drastically hit by recent climate change events, be it uneven rainfall, hailstorm, floods etc. Such conference will especially help not only the scientists, policy makers, marketing personnel but also students to be sensitized about the problems faced by stakeholders but also show untapped potential of agriculture and horticulture. The exposure will encourage the students to consider horticulture as better and/or alternate career pathway. I congratulate the organizers and wish them a grand success.

S.A. Wani

Dean Faculty of Horticulture

Cell: 9480696306

E-mail: deanpgs@uasraichur.edu.in

UNIVERSITY OF AGRICULTURAL SCIENCES, RAICHUR

[ICAR, NAAC accredited and UGC u/s 12(B) & 2(f) approved]

Dr. Gururaj Sunkad

M.Sc. (Agri.), Ph.D., P.D (USA), FIPS, FISMPP.

Dean (Postgraduate Studies)



MESSAGE

Climate change is the defining crisis of our time and it is happening even more quickly than we feared. But we are far from powerless in the face of this global threat. As Secretary-General António Guterres pointed out in September, “the climate emergency is a race we are losing, but it is a race we can win”.

No corner of the globe is immune from the devastating consequences of climate change. Rising temperatures are fuelling environmental degradation, natural disasters, weather extremes, food and water insecurity, economic disruption, conflict, and terrorism. Sea levels are rising, the Arctic is melting, coral reefs are dying, oceans are acidifying, and forests are burning. It is clear that business as usual is not good enough. As the infinite cost of climate change reaches irreversible highs, now is the time for bold collective action.

Climate change is impacting human lives and health in a variety of ways. It threatens the essential ingredients of good health, clean air, safe drinking water, nutritious food supply as well as safe shelter and has the potential to undermine decades of progress in global health.

5th international conference is being jointly organized by Sher-e-Kashmir University of Agricultural Sciences and Technology, Srinagar, Jammu and Kashmir, India, Agricultural and Environmental Technology Development Society (AETDS), U.S. Nagar, Uttarakhand, India, University of Agricultural Sciences, Raichur, Karnataka, India and Mid-West University, Surkhet, Nepal on the theme **Climate Change and its Impact (CCI-2023)** from June 9-11, 2023 is need of the day. I am confident that the proceedings of the conference will be of great use to the well acclaimed scientists, researchers, students, policy makers, farmers, entrepreneurs and stake holders engaged in the area of climate change impact on agriculture.

I wish the conference great success.

Date: 29-05-2023

Place: Raichur

(Gururaj Sunkad)
Dean (Postgraduate Studies)



DIRECTORATE OF EDUCATION
Main Campus Shalimar Srinagar-190025



MESSAGE

It is with great pleasure and excitement that I welcome you all to the 5th International Conference on Climate Change and its Impact, hosted by the Division of Basic Sciences and Humanities Faculty of Horticulture SKUAST K in collaboration with Agriculture & Environmental Technology Development Society, I am delighted to notice that experts, scholars, researchers, and enthusiasts have gathered to deliberate on one of the most critical challenges of our time.

This conference serves as a platform to exchange ideas, scientific findings, and best practices in tackling climate change across diverse sectors as the Climate change poses an unprecedented threat to our planet, ecosystems, and human societies.

Throughout the conference, we aim to foster interdisciplinary discussions, encouraging fruitful collaborations among participants from different backgrounds and disciplines. I am particularly excited about the presentations and panel discussions that will showcase ground breaking research, innovative technologies, and successful initiatives from around the world.

Furthermore, this conference will provide an opportunity for networking and forging meaningful connections. I encourage you to engage in fruitful conversations, build partnerships, and explore avenues for collaboration that will extend beyond the duration of this event. I extend my heartfelt gratitude to the organizing committee, the distinguished speakers, the esteemed sponsors, and all the participants who have contributed to the success of this conference Let us seize this opportunity to make a lasting impact on our planet.

I wish you all an enriching and rewarding experience at the International Conference on Climate Change and its Impact.

Prof. M. A. A SIDDIQUE
Director Education
SKUAST K



**VASANTRAO NAIK MARATHWADA KRISHI VIDYAPEETH, PARBHANI
AGRICULTURE TECHNICAL SCHOOL, NANDED, MS, INDIA, 431605**

Dr. Nareshkumar E. Jayewar
Ph.D.(Agril. Entomology)
Principal

Mobile : Mobile no.+91 9423 7 7 7 296
email : agritechschoollnanded@gmail.com



Message

I am glad to know that 5th International Conference on "Climate Change and Its Impact (CCI 2023)" the Agricultural and Environmental Technology Development Society (AETDS), U.K., India in collaboration with Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir (SKUAST-K) Srinagar, J&K., India, University of Agricultural Sciences Raichur, Karnataka, India, Mid-West University, Surkhet, Nepal, Vasant Rao Naik Marathwada Krishi Vidyapeeth, Parbhani, M.H. India and Sher-e-Bangla Agricultural University, Dhaka, Bangladesh with focus on various scientific tracks covering major areas of research on Climate Change: Challenges and Mitigation at Sher-e-Kashmir University of Agricultural Sciences and Technology (SKUAST-K) Srinagar, J&K., India on June 9-11, 2023.

Agriculture production is influenced by climatic and meteorological factors, but today's rising temperatures, precipitation, and CO₂ concentrations have a direct impact on crop productivity. Groundwater recharge, the water cycle, soil moisture, livestock, and aquatic species will all be impacted by climate change. Climate change increases the prevalence of pests and diseases, which significantly reduces crop yield. Climate change should be found to be responsible for declining soil fertility, increased salinity, resistance to many insecticides and herbicides, and declining irrigation water quality. So there is an urgent need to address this issue on this context discussion by international scientific community on different prospects of climate resilient agriculture in view of climate change and how climate resilient smart agriculture will definitely help in attaining sustainable livelihood.

Thus, the interactive sessions among the global scientists would definitely lead to the conclusion to formulate some useful recommendations for the upliftment and growth of end users worldwide. I am looking forward to an excellent meeting with renowned scientists, academicians, research scholars and youth from different countries around the world and sharing new and exciting results during the conference.

I wish grand success to the international conference.

Dr. Nareshkumar E. Jayewar
Principal
Agriculture Technical School, Nanded



Sher-e-Kashmir
University of Agricultural Sciences & Technology of Kashmir,
Division of Basic Sciences & Humanities
Faculty of Horticulture
Shalimar, Srinagar - 190025

Phone /9419002648/9682114438 Email: hodbsb2017@gmail.com /drkhanfa1966@gmail.com

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Dated: 29-05-2023

MESSAGE

On behalf of the Organizing Committee, I would like to cordially welcome you to the 5th International Conference on Climate Change and Its Impact (CCI 2023) being organized by the SKUAST-K in association with Agricultural & Environmental Technology Development Society (AETDS), U.K., India w.e.f. June 09 – 11, 2023 at SKUAST-K, Srinagar. The objective of this Conference is to provide a forum and opportunity for scientists, academia, industrialists and students to exchange their ideas and assess the latest developments under the scenario of global climate change in the fast-growing fields. In addition, it is an ideal venue for interactions and for them to establish the all-important contacts with each other.



This conference is the right platform to bring various stakeholders under one roof to discuss impact of climate change on food production system and strategies. Through this conference we will put all our effort to drive the policies on climate change and for better survival of human beings. We are planning to have best exhibition with multi domain displays and poster presentation. The thematic talks and the plenary sessions will drive you through the multi sectoral emergence in the field of agriculture and allied disciplines. This conference will provide a platform where everyone could have opportunity to showcase and present their ideas, thoughts, developments that could lead to a meaningful life. We are trying our best to ensure that your time and stay in the beautiful valley of Kashmir during the conference be one of the most memorable one and you go back with rich information and as a proud stakeholder of the field. I welcome you gain to this wonderful gathering and make the maximum out of it.

I thank each and every one of you who are contributing to the success of the conference and looking forward to seeing you all soon.

(Farooq Ahmad Khan)
Organizing Secretary
CCI 2023
Professor and Head
Division of Basic Sciences and Humanities



From the Desk of the Organizing Chairman

I am pleased to extend a warm welcome to all attendees of the International Conference on "Climate Change and Its Impact." This significant gathering brings together experts, researchers, policymakers, and stakeholders worldwide to address one of our time's most pressing global challenges.

Climate change threatens our planet and its inhabitants, and we must come together to deepen our understanding of its causes, impacts, and potential solutions. This conference is a platform for knowledge exchange, collaboration, and exploring innovative strategies to mitigate and adapt to climate change. Throughout the conference, we will engage in thought-provoking discussions, presentations of cutting-edge research, and insightful sessions that shed light on various aspects of climate change and its profound consequences. We aim to foster a multidisciplinary approach encompassing scientific, technological, economic, social, and policy perspectives.

I encourage all participants to actively contribute their expertise, share their research findings, and engage in fruitful discussions. Together, we can pave the way for effective climate action and sustainable development.

I am writing to thank the organizing committee, distinguished speakers, and sponsors for their dedication and support in making this conference a reality. Your commitment to addressing climate change is commendable, and your contributions are invaluable.

I wish you all a fruitful and inspiring conference experience. May our collective efforts drive positive change and contribute to a more sustainable and resilient future for future generations.

Best Wishes

Dr. Huma Naz
Organizing Chairman
CCI-2023



From the Desk of the Co-organizing Secretary

It's my immense pleasure and matter of pride that Agricultural & Environmental Technology Development Society (AETDS), U.K., India hosting three days International conference on "Climate Change and its Impact (CCI, 2023)." In association with Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir (SKUAST-K) Srinagar, J&K., India, University of Agricultural Sciences Raichur, Karnataka, India, Mid-West University, Surkhet, Nepal, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, M.H. India and Sher-e-Bangla Agricultural University, Dhaka, Bangladesh in the fort month of June i.e., (9th June, 2023-11th June, 2023).

This is a burning issue at the current world scenario. In the view of the focus on climate change and its impacts on agriculture and living world is an appropriate and relevant topic and is need of the hour to be emphasised. Scientists 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 combat with the changing climate. Combating climate change and ensuring food security are prime importance at this hour. So the intended three day International conference 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 scholarly 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 conference will bring glory in bringing up the modern solutions to the modern problems.

I look forward in welcoming you all to the beautiful city of Srinagar height in feet, known for its chain of icy Himalayas.

Dr. Kota Chakrapani
Co-organizing secretary (AETDS)
College of Agriculture, Central Agricultural University, Imphal



Ref: AETDS/SO/201

Date: 09.06.2023



From the Desk of the Chief Organizing Convener/ Secretary AETDS

I am delighted to invite you all for the upcoming 5th International conference “Climate Change and its Impact (CCI, 2023).” Organized by Agricultural & Environmental Technology Development Society (AETDS), U.S. Nagar, Uttarakhand, India, and hosted by Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir (SKUAST-K) Srinagar, J&K., India, and jointly organized by University of Agricultural Sciences Raichur, Karnataka, India, Mid-West University, Surkhet, Nepal, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, M.H. India and Sher-e-Bangla Agricultural University, Dhaka, Bangladesh in the fort month of June i.e., (9th June, 2023-11th June, 2023).

The major barricade of 21st century is climate change which is imposing serious threats to the nature, ranging from changing of weather patterns that imperil food production to rise in sea level that sinks the nations by causing catastrophic flooding. According to the research, the influence of human activities on climatic systems is unquestionable. Getting acclimatized to these repercussions in coming future will be more difficult and costly if strong actions are not taken.

The three-day conference gathers all the researchers worldwide focusing on climate change to unveil the best possible solutions and developments related to climate change. Reputed keynote talks and lead lecture series including air quality measures, use of smart techies in agriculture and sustainable food production, nature-based solutions and others will be discussed during this three-day significant gathering. The conference brings all the scientific people to join their hands that will end with challenges imposed by climate change by their novel works and suggestions.

I appreciate experts worldwide for their valuable time and willingness to share their wisdom through empirical evidence addressing different thematic areas of the conference.

I congratulate the CCI-2023 team for organizing the conference.

I wish the conference a grand success.

Wajid Hasan, Ph.D., PDF

Organizing Convener, CCI 2023

Secretary, Agricultural and Environmental Technology Development Society (AETDS), U. S.

Nagar, Uttarakhand, India

Krishi Vigyan Kendra, Jahanabad, Bihar Agricultural University, Bihar, India

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The Effect of Different Inorganic and Organic Fertilizers on the Growth of Chickpea Plant and Soil Organic Carbon and Nitrogen Contents

Nadia A. Si. El. Ahmed^{1,2*}, Feyzullah Öztürk¹, Gökhan Kişif¹, Kedir A. Fentaw^{1,3} and Ibrahim Ortaş¹

¹Department of Soil Science and Plant Nutrition, Faculty of Agriculture, Çukurova University, Türkiye

²Department of Soil and Environmental Sciences, Faculty of Agriculture, University of Khartoum, Sudan

³Department of Plant Science, College of Agriculture and Environmental Science, Arsi University, Ethiopia

Purpose

The world population is 8.1 billion and by 2050 it is estimated to be over 10 billion. The continuous increase in the world population is increased the food and settlement demand. As a result of economic and population growth, anthropogenic greenhouse gas emissions have increased drastically, with unprecedented CO₂ concentrations in the atmosphere and the absence of effective CO₂ capture systems. It is important to manage the soil and crop for better atmospheric CO₂ fixation to the soil. Chickpea (*Cicer arietinum L.*) plant, which establishes a symbiotic relationship with mycorrhiza and rhizobium bacteria, will supply more carbon and bind more atmospheric CO₂ to the soil. Chickpea is an important food source in human nutrition in that they are a good source of proteins and carbohydrates as well. In this context, the study aims is to find out the effect of different inorganic and organic fertilizations on the growth and nutrient content of the chickpea plant and also determine the soil's organic carbon and nitrogen content.

Material and Methods

A long-term field experiment was established in 1996 at Çukurova University, Research, and Application Farm. It was composed of 15 plots with a 200 m² area and laid out in a randomized complete block design with three replicates. The experiment treatments are; Control (without fertilizer), Mineral fertilizer (NPK), Animal manure (25 ton ha⁻¹), Compost (25 ton ha⁻¹), and Compost+Mycorrhiza (10 ton ha⁻¹). Chickpeas (*Cicer arietinum L.*) seeds were sown and harvested in 2020. During harvesting, plant samples were taken from a 1 m² area in the center of each plot, and soil samples were taken from rhizosphere and non-rhizosphere soils in the same points at 0-15 cm and 15-30 cm soil depths. Also, the morphological characteristics of chickpea roots were determined with the help of WinRhizo software. After harvest, plant tissue C, N, P, K and Zn concentrations and soil C and N concentrations were measured.

Results

The result showed that more carbon and nitrogen were measured in the animal manure applied plots compared to the control plots. Also, animal manure-treated plants has the highest root AMF infection rates. Mycorrhizae + compost applications contributed positively to all the traits examined. Organic fertilizers application could be an alternative to chemical fertilizers to increase chickpea growth and soil C and N concentration.

Conclusions

It is seen that the organic fertilizers including mycorrhizae inoculation to the soil contain more carbon than the control treatments. Animal manure, compost and mycorrhizae as organic fertilizers accumulated more organic carbon into soil depth. Through a long-term experiment, the data presented in this study revealed that the differences in the use of organic and inorganic fertilizers have a significant difference in carbon sequestration which is very important for mitigating atmospheric fixation of soil CO₂.

Keywords: Chickpeas, root infection, organic fertilizer and mineral, Carbon, Mycorrhizal Spores

Optimization of anti-candida efficacy of oils of *Thymus daenensis* L. and *Zataria multifera* L. using response surface and artificial neural methods**Mohd Sajjad Ahmad Khan***Department of Basic Sciences, Deanship of Preparatory Year and Supporting Studies, Imam Abdulrahman Bin Faisal University, Dammam, Saudi Arabia***Purpose**

The fungus *Candida albicans* is the most common species of yeast in humans, particularly in immunocompromised patients, causing superficial to deep mycoses. Antifungal agents given in combination may improve efficacy due to synergism, and because the dose can possibly be lowered, side effects could be reduced. However, Examination of the antifungal effect of EO mixture needs a process optimization. The present study was aimed to obtain optimum inhibitory concentration of oils of *Thymus daenensis* L. and *Zataria multifera* L. either alone or combined and duration of action against *Candida albicans*.

Methods

Response surface methodology (RSM) and artificial neural network (ANN) methods were used. Three factors were involved in Box-Behnken design for RSM model whereas the ANN comprised of three input and one output layer neurons.

Results

Considering the mean relative percent deviation, RSM model presented an excellent prediction for the antifungal effect in terms of all three variables. The optimum number of hidden neurons for ANN was found to be 13 when the lowest values of MSE for training, testing, and validation were determined. Both the kinds of optimization techniques predicted 0.8% as an optimum concentration of EO mixture in oils *T. daenensis*: *Z. multifera* 1:1, ensuring the highest antifungal effect of 95.8% and 96.4% after 20 h, respectively for RSM and ANN.

Conclusions

Appraisal of the models through the coefficient of determination (R^2) and mean-square error (MSE) show that the ANN was superior ($R^2= 0.994$) to the RSM model ($R^2= 0.957$) in predicting the percentage of reduced cells.

Keywords: Artificial neural network, *Candida albicans*, Response surface, *Thymus daenensis*, *Zataria multifera*

Under Long -Term Field Experiment, The Effects of Organic and Inorganic Fertilizers Application on Maize Growth and Soil Organic Carbon Sequestration.**Veysi Aksahin, Busra Nur Gulunay, Deniz Coban and Ibrahim Ortas***Department of Soil Science and Plant Nutrition, Faculty of Agriculture, University of Cukurova, Adana, Turkey***Purpose**

The increasing world population increased the demand, which creates serious negative pressures on agricultural soil and atmosphere environment. The most important of these pressures are the greenhouse gasses such as carbon dioxide (CO_2) released into the atmosphere. Increasing CO_2 and equivalent gases causes climate change and global warming. The purpose of the work was to determine different inorganic and organic fertilizer (including mycorrhizae) sources on carbon sequestration under long-term cropping systems.

Material and Methods

A long-term field experiment has been conducted since 1996 at Cukurova University Research and Implantation Farm, Adana/Turkey. Since that time, the experiments are consecutively cropped under several plant species. In 2022, before cultivation, routine fertilizer treatments corresponding to control (without fertilizer), Mineral fertilizer (NPK), Animal manure (25 ton ha^{-1}), Compost (25 ton ha^{-1}) and Compost+Mycorrhiza (10 ton ha^{-1}) were assigned to the

relevant plots. Maize seeds were sown to plots. At harvest, soil and plant samples were taken. Soil and plant total and organic carbon analyses were made by CN analyzer.

Results

Results show that fertilizer applied plots plant grain, shoot and root carbon concentration (percentage) were higher than that of the control treatments. Compost and animal manure treated soil at different depths (0-15 cm and 15-30) have higher total carbon (TC) percentage, organic carbon (OC) percentage concentration. The highest values of soil OC percentage and inorganic carbon (IC) percentage contents at Rhizosphere 0-15 cm depth were obtained in animal manure applied plots. Organic fertilizers application increased soil TC % and OC % contents as well as contributed to the soil carbon budget.

Conclusions

As a result, it is seen that organic fertilizers applied to the soil hold more carbon compared to the control treatments. Compost and animal manure as organic fertilizers, hold more organic carbon into soil depth. Through long-term trial, the data in the present study was revealed that the differences organic and inorganic fertilizers application have a significant difference on carbon sequestration which is very important to mitigate atmospheric CO₂ fixation to soil.

Keywords: Maize, Soil Organic carbon, Organic and Mineral fertilizer. Carbon Sequestration, Long-term field experiment

Influence of different doses of natural flavonoid on nutrient digestibility, gut microbial status, growth performance, and meat quality of growing rabbits

M A Rahman, M Hassan, R Chowdhury

Department of Animal Nutrition, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh

Purpose

The study aimed to investigate the optimum dose of rutin, a natural flavonoid, on the growth performance, nutrient digestibility, gut microbiota, and meat quality of growing rabbits.

Methods

The impact of feeding different doses of rutin, a natural flavonoid, on the growth performance, nutrient digestibility, gut microbiota, carcass, and meat quality of rabbits was investigated over the period of five weeks. A total of 60 New Zealand White growing rabbits were given to five diets, having three replicates and four rabbits each. Rabbit daily offered basal diet (concentrate and *ad libitum* roughage) with 0.0, 0.2, 0.4, 0.6 and 0.8 g rutin per kg diet and reflected as R₀, R₁, R₂, R₃ and R₄ diets. Record of feed (roughage and concentrate) intake, feces weight were maintained during last five days of trial for the measurement of nutrient digestibility. After slaughtering, the meat was immediately kept at freeze for 24 hour at 4⁰C, then the meat sample were taken out from the freeze and waited for room temperature and finally meat color was measured using colorimeter (CR-410, Mintola, Japan).

Results

Rabbits given rutin's diets revealed cubic effects on digestibility of total digestible nutrients (TDN), digestible crude protein, digestible ether extract, digestible crude fiber, and digestible nitrogen free extract, while remarkably 10-12% better TDN digestibility was obtained in rabbits fed R₃ compared to all diets (P<0.05). Besides, compared to R₀, ceacal total viable count was obtained lower in rabbits fed rutin of R₁ and R₃ diets, while better value of *E. coli* and *Lactobacillus spp.* were measured at R₄ and R₃, diets, respectively compared to all diets (P<0.05). The rabbits fed to R₃ diet showed better tendency of higher body weight gain, average daily gain, and growth velocity compared to R₀, while final body weight and dressed yield were unaffected among all diets (P>0.05). Meat protein contents, redness (a), yellowness (b), saturation index and hue angle were increased linearly in rabbits given different rutin's diets

($P < 0.05$), while best result was obtained in rabbit given R_4 diet but no statistical variation was obtained between R_4 and R_3 diet ($P > 0.05$).

Conclusions

Moreover, among all diets, 0.6 g rutin /kg diet (R_3) can improve nutrient digestibility, caecum beneficial bacteria, growth performance, and meat quality of growing rabbits.

Keywords: Dose titration, meat quality, performance, rabbit and rutin.

Grain Yield and Nutrient Contents of Wheat (*Triticum aestivum*), and Selected Soil Properties after 23 Years of Phosphorus Fertilizer Application

Kedir A. Fentaw^{1,2*}, Yusufalp Kamışlı¹, Feyzullah Öztürk¹, Nadia A. Si. El. Ahmed^{1,3}, and Ibrahim Ortaş¹

¹ Department of Soil Science and Plant Nutrition, Faculty of Agriculture, Çukurova University, Turkey

² Department of Plant Science, College of Agriculture and Environmental Science, Arsi University, Ethiopia

³ Department of Soil and Environmental Sciences, Faculty of Agriculture, University of Khartoum, Sudan

Purpose

Phosphorus (P) fertilizer and wheat fertilization are part of the green revolution that has been practiced for decades to boost the growth and productivity of crops. However, the application of P fertilizers has various effects on the soil's properties, growth, and nutrition of crop plants. To evaluate the long-term effects of P fertilizer application on the yield of wheat and other crops in the rotation, as well as on the soil properties, a long-term field experiment was established in 1998 in the semi-arid region of Turkey.

Methods

Since 1998, four different doses of P (0, 50, 100, and 200 kg P_2O_5 ha⁻¹) as triple-superphosphate have been applied yearly in the consecutive cropping systems at the research farm of the Soil Science and Plant Nutrition Department, Çukurova University, Adana. In the current study, wheat crop was sown in October 2021, and harvested in May 2022. It was composed of 12 plots with a 200 m² area and laid out in a randomized complete block design with three replicates. During harvesting, plant samples were taken from a 1 m² area in the center of each plot, and soil samples were taken from the same point at 0-15 cm and 15-30 cm depths. Selected soil properties, grain yield, and P, K, and Zn concentration of plant tissue were determined.

Results

The result shows that with increasing P application doses, the soil P content, grain yield, and grain K and P content increased. The highest grain yield (3914 kg ha⁻¹) was recorded in a plot that received 100 kg P_2O_5 ha⁻¹, while the lowest yield (2249 kg ha⁻¹) was obtained in control plots where no P was applied. Long-term P application increased and maintained the soil P content at a higher level. Due to this fact, the increment in wheat grain yield after 23 years of application was statistically insignificant. On the contrary, grain Zn concentration and the number of mycorrhizal spores decreased as P dose increased. A higher P level can interfere with the grain's Zn uptake as it has an antagonistic effect. Similarly, mycorrhizal root colonization and the number of mycorrhizae spore were reduced when the P level in the soil was higher.

Conclusion

In the study area, 50 and 100 kg P_2O_5 ha⁻¹ are an optimal rate for wheat production in terms of grain yield and grain Zn content, respectively. However, the association among other soil and crop parameters, the economic and ecological feasibility of the applied P doses should also be considered to draw a more comprehensive recommendation.

Keywords: Phosphorus, Long-term field experiment, Wheat, Grain-yield, Mycorrhizae Spores, Wheat grain Zn concentration

Biostimulants for Enhancing Metal/Metalloid Tolerance in Plants

Mirza Hasanuzzaman

Department of Agronomy, Faculty of Agriculture, Sher-e-Bangla Agricultural University, Dhaka-1207, Bangladesh

Abstract

Sustainable crop production is key to global food security. With progress in industrialization threats of pollution are increased and one of them is metal toxicity. Some metals are necessary but are required in minor amounts for proper functioning but some metals/metalloids are not necessary for plants and their abundance show deleterious effects. Contamination of soil by metals/metalloids occur by many hazardous human activities, biological and chemical reactions taking place causing pollution and due to many reasons metals leach down the soil, contaminate it and cause hazards for plants. Metals/metalloids in excessive concentration cause negative effects in plants, humans, and microorganisms. Fertilizers, sludge, and industrial waste deposit into soil and accumulate by plants grown on roadsides usually in urban areas. Increase in concentration on metal in soil over the safe limits, affects the crop productivity and enhances the chances of food toxicity. To overcome the toxic effects of metal adulteration, it is necessary to understand the crop response to metal toxicity. Therefore, finding appropriate approaches in enhancing plant metal/metalloid tolerance is one of the priority areas for 21st century crop improvement. In a modern world deprived and driven by technology, learning to 'do smarter and not harder' is the first step towards sustainability. With the introduction of sustainable agriculture, bio-stimulants came into play as a bridge, when applied to crops or seeds, bring about changes in physiological and structural processes to influence plant growth via reduced use of synthetic chemicals and fertilizers, improved tolerance to various stresses, efficacy in nutrient uptake and use, and improved, good quality yield. Biostimulants are a group of substances or microorganisms, whose have a positive impact to enhance plant growth, availability of nutrient, and improvement of metal/metalloid stress tolerance in crop plants. Biostimulants are mostly exogenous compound(s) or microorganisms, which applied in plant or root zone (rhizosphere) to improve nutrient uptake, plant growth, crop quality and metal/metalloid stress tolerance. In the recent years several biostimulants have been used for crop production which includes humic and fulvic acids, seaweed extracts, beneficial fungi; mycorrhizal fungi and *Trichoderma*, and beneficial bacteria; plant growth-promoting rhizobacteria. These biostimulants not only resulted in better plant growth and development but also provided better tolerance to metal/metalloid stress. Moreover, modern agriculture is shifting toward organic environment amicable and everlasting systems to improve yield as well as crop quality without increasing the inputs. To achieve sustainability, species-specific breeding program is going on, which is time-consuming. Contrary, an improved cultivar from breeding program may not be tolerant of the metal/metalloid stress; if so, may tolerate one or two specific metal/metalloid stress conditions. Therefore, biostimulants could be an excellent and viable alternative in this case, which are capable to enhance the growth of plants, improve the nutrient uptake, increase tolerance to metal/metalloid toxicity, and expand crop quality traits along with a good yield.

Mitigation of Nickel Stress in Rice by Exogenous Application of Biochar and Chitosan

Md. Rakib Hossain Raihan and Mirza Hasanuzzaman*

Department of Agronomy, Faculty of Agriculture, Sher-e-Bangla Agricultural University, Dhaka-1207, Bangladesh

Abstract

Nickel (Ni) is considered as an essential micronutrient for plants, but it becomes phytotoxic at supra-optimal level which leads to inhibition of seed germination, growth and yield reduction as a response of physiological and biochemical dysfunction. Therefore, an experiment was conducted at the shed house of the Department of Agronomy, Sher-e-Bangla Agricultural University, Dhaka-1207, Bangladesh to investigate the morphological, physiological, and biochemical responses of rice (*Oryza sativa* L. cv. BRRI dhan96) upon exposure to different levels of Ni and to study the protective role of biochar (BC) and chitosan (CHT) in mitigating Ni stress. Twenty-one days after transplanting (DAT), rice seedlings were exposed to Ni stress by treating with 0.5, 1.0, and 2.0 mM NiSO₄·6H₂O for four times. Exogenous supplementation of BC (0.5 g kg⁻¹ soil) was done once before seedling transplantation and the CHT (200 mg L⁻¹) was applied at seven-day intervals from 14 DAT to panicle initiation as foliar spray. The experiment was conducted in a completely randomized design with three replications and all the obtained data was subjected to one-way analysis of variance. Exposure to Ni stress exhibited a notable increase in hydrogen peroxide content, lipid peroxidation, and electrolyte leakage indicating Ni-mediated oxidative damage in the rice plants. Consequently, the Ni stressed plants showed a reduction of plant height, tillers hill⁻¹, leaf area, root fresh weight, shoot fresh weight, root dry weight, shoot dry weight, soil and plant analysis development value, and yield attributes in a dose dependent manner. The relative water content of the Ni treated plants also reduced with a concomitant increase in the proline accumulation. Supplementation with BC and CHT mitigated the deleterious effects of Ni toxicity in plants as reflected in enhanced growth and physiological attributes under different levels of Ni. Increase of ascorbate and glutathione with the concomitant reduction of dehydroascorbate and glutathione disulfide was observed when BC and CHT was supplemented in the Ni stressed plants. Moreover, the yield attributes such as effective tillers hill⁻¹, panicle length, rachis panicle⁻¹, filled grains panicle⁻¹, and 1000-grain weight were also increased when BC and CHT were applied, thus the grain yield hill⁻¹ was increased under Ni stress. These findings indicated a protective role of BC and CHT against Ni-induced damages by enhancing physiological and biochemical processes of rice.

Starch Extraction from Agricultural Wastes and its Nanocomposites for Food Packaging Applications**Shanta Pokhrel Bhattarai***Department of Chemistry, Tri-Chandra Multiple Campus, Tribhuvan University, Kathmandu, Nepal***Purpose**

Among the total of food wastes 14.8% are from fruit/vegetable production and processing. There is a possibility of fruit wastes valorization, it stands out their use in the production of biopolymers, like starch. Here, environment-friendly isolation of starch from pineapple stem waste is a remarkable way to reduce agricultural waste and gain the potential benefit from the nature at the same time.

Plastic pollution has become one of the most pressing environmental issues especially in developing countries. In this regard developing the starch based biodegradable poly(butylene adipate-co-terephthalate) (PBAT) bioplastic will help to address environmental issue created by plastic pollution as well as it reduces the high demand of synthetic polymers.

Methods

Starch extracted from pineapple stem waste by chemical method and fabricated of it with poly(butylene adipate-co-terephthalate) (PBAT) *via* solution casting method to obtain starch based nanocomposites. These biofilms was characterized by Fourier transform infrared

spectroscopy (FTIR), X-ray diffraction (XRD), scanning electron microscopy (SEM), thermogravimetric analysis (TGA) and biodegradation behaviour was studied by soil composting method.

Results

This work prepared the cost effective modified starch based bioplastics with desired mechanical, thermal, biodegradation and antimicrobial properties which help to reduce the cost of expensive biodegradable plastics by applying naturally abundant biomass source. Production of bioplastic will be helpful to reduce the plastic waste and its impact on health and environment.

Conclusions

Pineapple starch based bioplastics can be used for food packaging which will be helpful to reduce the plastic waste and its impact on health and environment.

Keywords: Biodegradation, FTIR, PBAT nanocomposites, SEM, Starch

Evaluation of *Paecilomyces tenuis* producing Huperzine A for the management of root-knot nematode *Meloidogyne incognita* (Nematoda: Meloidogynidae)

Rami Kassam · Virendra S. Rana · Aditi Kundu · Gautam Chawla · Uma Rao

Ministry of Agriculture – Syria

Purpose

Root-knot nematodes (*Meloidogyne* spp.) are notorious plant-parasitic nematodes that affect agricultural crops. These obligate soil-dwelling parasites typically maneuver the host plant physiology by forming specialized feeding cells resulting in heavy yield losses. Scant management tools are available to effectively combat this pest.

Methods

In an exploratory attempt of identifying new fungal biocontrol agent(s) for *M. incognita* from India, a *Paecilomyces tenuis* isolate from rhizosphere soil was found to incur > 90% mortality of the infective second-stage juveniles (J2s) at 24 h post-exposure to the fungal filtrate with about 87% parasitization. The fungal filtrate also significantly reduced the egg hatching and host-root penetration of *M. incognita* under in vitro and in vivo conditions revealing its effectiveness in curbing nematode pathogenicity with positive effects on plant growth.

Results

A quantitative nature of resistance to *Fop*, ranging from highly to partially resistant and susceptible accessions was detected, with resistance being the most frequent phenotype. Diverse colonization patterns were observed, suggesting the existence of different resistance mechanisms. In the highly resistant accessions, absence of fungal colonization in the vascular tissue was detected, while fungal progression was arrested at the level of roots both in highly resistant and partially resistant accessions. Chromatographic analyses revealed the presence of Huperzine A (433.56 mg L⁻¹) in the *P. tenuis* isolate.

Besides, the isolate possessed acetylcholinesterase inhibition attribute with an IC₅₀ of 2.85 ± 0.12 mg mL⁻¹ of the fungal filtrate. Further, GC-MS analysis revealed the production of other nematicidal compounds by the fungus including acetic acid. To conceptualize the mode of nematicidal action, RNA-Seq was done post-treatment of the *M. incognita* J2s and model worm *Caenorhabditis elegans* with fungal filtrate and pure Huperzine A. The transcriptomic profile unravelled the molecular intricacies underlying the nematicidal action affecting several biological pathways and developmental checkpoints of the nematode.

Conclusions

Thus, the *P. tenuis* isolate offers significant potential to be used as a biocontrol agent against *M. incognita* along with its commercial use for Huperzine A production

Keywords: Acetylcholinesterase · Biocontrol · Huperzine A · *Meloidogyne* · *Paecilomyces tenuis* · Nematicidal

Effect of Increasing Phosphorus Doses Application on Some Physical, Chemical and Biological Properties of Soil, Under Long-Term Experiment Conditions
Mehmet İŞIK^{1,*}, Serra ALDOĞAN¹, Mert SÖNMEZ², Seher İLHAN¹ and İbrahim ORTAŞ¹

¹Department of Soil Science and Plant Nutrition, Faculty of Agriculture, University of Cukurova Adana, Turkey

¹Department of Plant Protection, Faculty of Agriculture, University of Cukurova Adana, Turkey

Purpose

Phosphorus fertilizers are produced from rock phosphate (apatite), however, they are in low-mobility in soil for plant nutrient absorption uptake. In addition, the rock phosphate quantity is a limited source for future P fertilizer. At the same time, high phosphorus fertilization will be caused environmental pollution (such as eutrophication in rivers). Also, a large proportion of applied P fertilizer is remained in the soil and caused to reduce the viable soil organisms. Therefore, the effect of increasing doses of phosphorus application on some soil properties (as physical, chemical and biological) is not entirely understood in literature, under long-term experiment conditions. Also, phosphorus fertilizer application indirectly caused decreases in plant growth and yield.

The aim of the study to understand the effect of increasing P doses application on some physical, chemical and biological properties of the soil, under long-term experiment conditions. The hypothesis to be tested is that under long-term field experiment conditions, increasing doses of phosphorus fertilizer negatively affects the soil properties.

Methods

The field experiment was established in 1998 and has continued uninterruptedly to the present time under maize and wheat rotations. Four doses of P fertilizers applied; such as 0, 50, 100 and 200 kg P₂O₅ ha⁻¹ application with tree replications. P2105 Maize (*Zea mays* L.) species seeds were sown in June 2022 and harvested at November 2022. At harvest, the soil samples were taken at 0-15 cm and 15-30 cm depth in each plots. Soil Organic Matter (by walkley-black method), soil pH, EC and available P were analyzed as soil chemical properties. The number of mycorrhizal spores were determined by soil biological properties. Furthermore, soil bulk density (Bd), water stabile aggregated (WSA) and mean weight diameter (MWD) were analyzed as soil physical properties.

Results

Phosphorus application in increasing doses negatively affect soil physical properties (such as WSA, MWD and Bd) under long-term field experiment condition. The research finding showed that depending on increasing P doses application soil Bd, WSA and MWD were decreased. While depending on increasing P doses application soil organic carbon increased, however, the number of mycorrhizal spores and root colonization were decreased.

Conclusions

The results are revealed that for sustainable and eco-friendly crop production, 50 and 100 kg P₂O₅ ha⁻¹ P fertilizer can be used in maize production.

Keywords: Long-term field experiment, Soil organic carbon, maize plant, soil MWD, WSA, Phosphorus doses fertilizer

The Effect of Mycorrhiza Inoculation on Pepper Plant Growth and Mycorrhizal Dependency

Efe SOYLU¹, Mehmet İŞIK^{1,*} and İbrahim ORTAŞ¹

¹Department of Soil Science and Plant Nutrition, Faculty of Agriculture, University of Çukurova Adana, Turkey

Purpose

Pepper cultivation that is one of the vegetables that are widely produced in world. The use of mycorrhiza in the sustainable agriculture can be an environmentally friendly and economical agriculture strategy. The aim of the study; to investigate the effect of mycorrhiza inoculation on plant growth development, yield and mycorrhizal dependency. The hypothesis to be tested is; inoculation of mycorrhiza increase pepper plant growth parameters.

Methods

The experiment was established as a pot experiment under greenhouses conditions in February 2018 and harvested in April 2018. BT 16-90 F1 pepper species seeds were used with mycorrhiza (*Glomus.etunicatum*) and without mycorrhiza inoculation with three replications. Before harvesting, plant height and leaf diameter were measured. At harvest, dry and fresh weight of root and shoot were measured. In addition, some of root morphological properties (root diameter, root length, root surface area and root volume) were determined by using WinRhizo program. In addition, mycorrhizal root infection were determined. Mycorrhizal dependency was calculated by using dry matter data.

Results

Research findings showed that mycorrhizal inoculation increased pepper plant root, shoot fresh and dry weight, plant height, and leaf diameter. In addition, the root length of the plants with mycorrhiza inoculation (as 3921 cm pot⁻¹) was higher than without mycorrhiza (with 1945 cm pot⁻¹) treatments. The pepper plant has a high mycorrhizal dependency (71.9%) with *Glomus.etunicatum* inoculation.

Conclusions

The results revealed that *Glomus.etunicatum* inoculation increased pepper plant growth and development. Also, pepper plant is highly mycorrhiza-dependent plant.

Keywords: Pepper, mycorrhizal dependency, shoot and root growth

The Effect of Different Mycorrhizal Fungi Inoculation and Biochar Application on The Growth of Broad Bean Plant and Carbon Sequestration Under Different Irrigation Levels.

Feyzullah Öztürk, Veysi Aksahin, Yassal Khan and Ibrahim Ortas

Department of Soil Science and Plant Nutrition, Faculty of Agriculture, University of Çukurova, Adana, Turkey

Purpose

Today, the world population has exceeded 8.1 billion and is expected to exceed 10 billion by 2050. Population growth brings many negativities impacts on ecosystems such as global warming and climate change. It is expected that population growth will naturally increase by almost two times food production and at the same time water consumption will increase. As a country like Turkey, which is on the border of water scarcity, it will be one of the most important strategies for the future to activate the natural mechanisms of plants' rhizosphere in a way that will add more carbon to the soil in the axis of water management. In light of this information, the aim of the study is to investigate the effects of different irrigation levels on the development of the bean plant grown under different biochar applications and soil organic carbon sequestration.

Material and Methods

The research was carried out in Çukurova University, Faculty of Agriculture, Soil Science and Plant Nutrition Research Greenhouses, Adana-Turkey. The experiment was carried out as a total of 54 pots, with 3 replications according to the randomized plots trial design. In the experiment, the broad bean (*Vicia faba*) plant was planted as plant material on the Arik soil

series soil. The experiment was designed with 3 restricted irrigation levels (50%, 75%, and 100% of the field capacity) and mycorrhizal fungus (non-mycorrhizal, *G. Mosseae*, and Natural mycorrhiza), and with 1 % of biochar and without biochar application. After harvest plant growth parameters, carbon, and nitrogen analyses in plant tissue and soil samples were carried out.

Results

The data obtained in the study were determined to develop better at 100% irrigation level under the conditions of biochar and *G. Mosseae* inoculation. Carbon and nitrogen values were higher in bean plants in pots inoculated with mycorrhiza and treated with biochar application.

Conclusions

As a result, it was observed that more carbon was bonded in the pots treated with biochar and *G. Mosseae* mycorrhiza inoculation than in the control treatments. Mycorrhiza and biochar applications enable the plant to grow better and they have played an important role in binding the atmospheric CO₂ fixation to the soil.

Keywords: Carbon, Mycorrhiza inoculation, Biochar, Broad bean plant, Water use efficiency

Prioritizing Tree Based Systems for Optimizing Carbon Sink in the Indian sub-Himalayan Region

Sumit Chakravarty*, Manendra Singh and Gopal Shukla

*Department of Forestry, Uttar Banga Krishi Viswavidyalaya
Pundibari- 736 165, Cooch Behar, West Bengal, India*

Purpose

Land resources have been under tremendous anthropogenic pressure with the consequence of their degradation. It is therefore necessary that the land resources must be managed effectively for sustainable development. Different from the developed countries, carbon inventories and data bank to monitor carbon sequestration potential of different ecosystems are unavailable in India. Micro-level studies are essential for sustainable land use management for a land scarce nation like India.

Methods

To achieve the desirable goal of the present study, a total of 33 tree-based land uses were identified from forested and agricultural landscapes of Terai region of West Bengal. Of these total land uses, five were in forest landscapes and rest in agricultural landscapes categorized into forest tree plantations (8 land uses), agroforestry (nine land uses), commercial crop plantations (six land uses) and fruit orchards (five land uses). A stratified random nested quadrat sampling method was adopted for vegetation analysis of the different land uses.

Results

The SOC, biomass and carbon accumulation in the tree-based land uses were significantly different from each other. Mixed forest soil had the highest amount of SOC, primary nutrients, standing biomass carbon, and ecosystem carbon. Positive correlations were observed between SOC, total standing biomass, litter production, and ecosystem carbon. The sequence of best tree based land uses in terms of total SOC (up to 60 cm depth), total plant biomass, total plant biomass carbon and ecosystem carbon was mixed species forest (126.67, 781.21, 390.61 and 517.27) > sole tree species stands in forest landscape (109.71, 192.56, 96.28 and 205.98) > tea plantations (103.19, 77.07, 38.54 and 141.74) > homegardens (90.34, 97.38, 48.69 and 139.02) > mixed plantation of *Anthocephalus cadamba* + *Swietenia macrophylla* (60.07, 111.86, 55.93 and 116.02) > *Swietenia macrophylla* based agroforestry (62.49, 83.82, 41.91 and 104.40) > mixed plantation of *Tectona grandis* + *Milvus migrans* (60.0, 85.97, 42.99 and 102.90). Similarly, the order of the major land uses was forest > commercial crop plantation > forest tree plantations > agroforestry > fruit orchards. The overall average ecosystem carbon accumulation in forests was 3.24 times more than the land uses in agricultural landscapes. The

SOC, biomass and carbon accumulation in the tree-based land uses were significantly different from each other. Mixed forest soil had the highest amount of SOC, primary nutrients, standing biomass carbon, and ecosystem carbon. Positive correlations were observed between SOC, total standing biomass, litter production, and ecosystem carbon. The sequence of best tree based land uses in terms of total SOC (up to 60 cm depth), total plant biomass, total plant biomass carbon and ecosystem carbon was mixed species forest (126.67, 781.21, 390.61 and 517.27) > sole tree species stands in forest landscape (109.71, 192.56, 96.28 and 205.98) > tea plantations (103.19, 77.07, 38.54 and 141.74) > homegardens (90.34, 97.38, 48.69 and 139.02) > mixed plantation of *Anthocephalus cadamba* + *Swietenia macrophylla* (60.07, 111.86, 55.93 and 116.02) > *Swietenia macrophylla* based agroforestry (62.49, 83.82, 41.91 and 104.40) > mixed plantation of *Tectona grandis* + *Milvus migrans* (60.0, 85.97, 42.99 and 102.90). Similarly, the order of the major land uses was forest > commercial crop plantation > forest tree plantations > agroforestry > fruit orchards. The overall average ecosystem carbon accumulation in forests was 3.24 times more than the land uses in agricultural landscapes. The ecosystem carbon accumulation in the tree-based land uses in both forest and agricultural landscape was highly variable and was significantly different from each other.

Conclusions

Land use conversion from forest to agriculture can reduce more than half of the carbon stock, but converting into homegardens, tree plantations or agroforestry enhanced carbon storage of the land use systems. The present findings can be used as baseline information for developing prediction models for probable effects of different land use, future intervention and sustainable management of land use systems.

Keywords: Land use; landscape; climate change; Carbon; sub-humid tropic; Himalayas

Assessment of Land use dynamics: An Analysis on Interactions of Natural Ecosystem and Human Decisions

Jagrati B Deshmanya, Vijayachandra Reddy,S., Vasudeva Naik,K and Mallikarjun Mudappa

University of Agricultural Sciences, Raichur, Karnataka, India

Abstract

The present study aims to analyze the land use dynamics of India. The study has used secondary data over period of 62 years.i.e from 1960-2022 and analyzed data using compound annual growth rate and Percent change formula to assess Change Detection and also to draw meaningful interpretations from the gathered information. The findings reveals that, among the growth was found to be positive in Pattern of Land Use especially in case of Net Irrigated Area and Gross Irrigated Area and in case of net sown and gross sown area the growth was less than 1 percent over a period of 62 years. Further, the growth trends related to Area under Non-Food Crops reveals that, there was decline in Groundnut and linseed and highest was found in rapeseed & mustard (2.68%). The findings also states that, Cropping Intensity of southern was negative when compared to northern states of India. The study suggests that, more number of government interventions is required in order to regulate strict natural resource management activities for efficient use of scared resources.

Keywords: Climate Change, Land Use, Area, Gross Sown area, Cultivation

Introduction

Land-use change is a locally all-encompassing and globally important environmental trend. Vitousek (1994) notes that “three of the well-documented global changes are rising due increasing carbon dioxide concentration in the atmosphere; alterations global nitrogen cycle due to change in the biochemistry; and on-going land-cover and land-use change.” Humans interactions have resulted in transformation of significant segment of the Earth’s land surface about 10 to 15 % presently is dominated by agricultural crop or urban-industrial areas, and

decline in area of pasture (Vitousek et al. 1997). Further, many research studies conveys that, change in land use has potential impact on future generation for all resource use and mobilization (Wear,1998).

The land-use changes have important impact for future changes in the climate and, consequently, great implications for subsequent land-use change and earth's environment (R. Costanza, R. de Groot, P. Sutton et al, 2014). Thus, the U.S. Department of Agriculture's (USDA's) Forest Service (FSGCRP) has drawn a critical element for the Global Climate Change Program to understand the interactions between natural resources and human activities. In particular, FSGCRP in many policy oriented dialogues, they have identified three critical actions for this program. They are as mentioned below

Identify and evaluate the forest ecosystem structure which effects the changes in and function on human communities and society in response to global climate change.

Identify and evaluate forestry policy options for rural and urban in order to mitigate and adapt to the effects of global climate change.

Identify and evaluate forest management activities especially for potential rural and urban areas in order to integrate risks associated with global climate change.

In addition to above criteria, attention has focused environmental impact assessment models especially on land-use change models. Land-use models need to be built on good science and based on good data. Technical innovations are very much need of present research models which can exhibit a high degree of scientific rigor and contribute some original theoretical insights for long term developments (H. Long, 2008 and X. Li, 2016). However, originality is less important in policy models, and sometimes it is more desirable for a model to be considered "tried and true" concepts for original contributions to the science of environmental modeling (Couclelis 2002).

Complexity nature of Human Decision making is the major impact of human actions on land use and land cover, it is essential that models of these processes illuminate factors that affect human decision making. Many theoretical traditions inform the theories that researchers use when modeling decision making. Some researchers are influenced by deterministic theories of decision making and do not attempt to understand how external factors affect the internal calculation of benefits and costs (Hayden, 1993).

To further illustrate this need, we examine the simplified model in Figure 01, which describes a general, traditional, conceptual framework that many environmental economists have used to study ecosystems. Although this conceptual model is influential in its inclusion of both ecological and human based processes, important interactions such as land use, land cover, production and consumption and feedbacks for change in policy making influencing long-term ecosystem dynamics are absent (Evans, *et al.* 2001).

An activity such as land use, traditionally seen as a driver, also can be viewed as the result of more fundamental social and ecological patterns and processes. Incorporating greater contributions from the social sciences with existing biophysical/ecological models could greatly enhance our understanding of global change in general, and land-use change in particular (Mahapatra, A. K. 2000). In contrast to Figure 01, the study proposes a more dynamic framework that explicitly links what is often divided into separate "natural" and human systems into a more integrated model (Fig. 01).

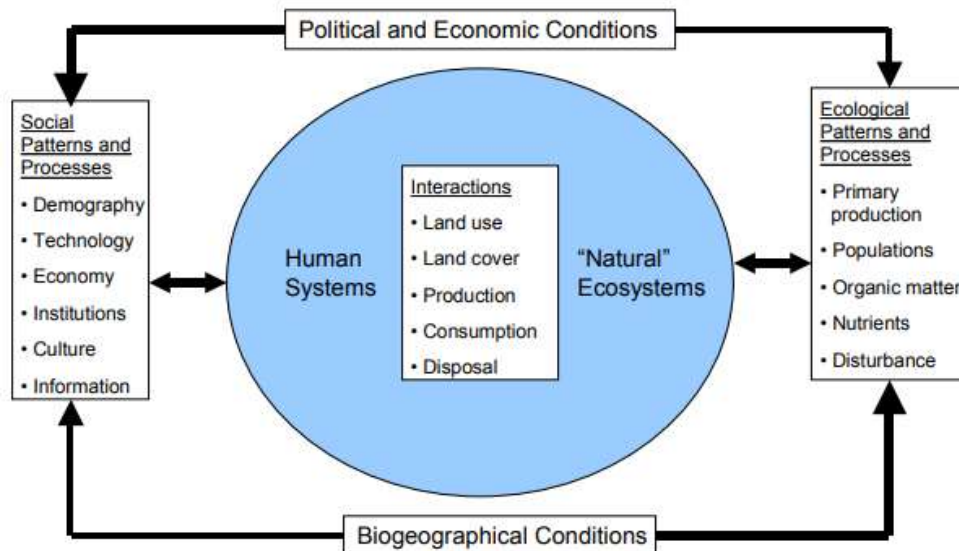


Fig.01 Conceptual framework for inspect the human ecosystems.

Methodology

The present status aims to study the land use dynamics in terms of change in area in land for agriculture and other parameters were selected for the study during the period from 1960 to 2022. Thus, secondary data related to Net Sown Area, Gross Sown Area, Net Irrigated Area, and Area under Cultivation of food grains and Area under Non-Food Crops *etc.* were collected and analyzed from the year 1960 to 2022 to draw meaningful conclusion using appropriate tools for the study. The tools for assessing the growth trend analysis was used and for percent change the methodology adopted by Reuben C. Rutttoh *et al*, 2022 was used. The details as follows;

Trend analysis: The exponential growth function was used to estimate the growth rates of the selected economic variables and the model as mentioned below

$$Y = abt e$$

Where,

Y= Dependent variable for which the rate of

increase/decrease is estimated (such as Net Sown Area, Gross Sown Area, Net Irrigated Area and other parameters).

a = intercept

b = regression coefficient

t = time variable (1960 to 2022)

e = error term

The compound growth rate was obtained from the logarithmic form of the equation $Y = abt e$ as below $\ln Y = \ln a + t \ln b$, the percent compound growth rate (y) was derived using the relationship $y = (\text{Anti ln of } b - 1) \times 100$.

The methodology was used to assess the percent change in land use, which was adopted by 2022 Reuben C. Rutttoh *et al*. The percentage of change, and the annual rate of changes for the periods were calculated using the following equations: Change ($A_j - A_i$), % Change = $((A_j - A_i) / A_i) \times 100$.

Results and Discussion

The growth trends findings shows that, among Pattern of Land Use, there was positive growth was observed in case of Gross Irrigated Area with growth of 2.13% followed by net irrigated area (1.74%). However, in case of gross sown area the growth was only 0.44% and in net sown area it was negligible about 0.07%. The probable reason can be introduction of many cannels for rural area has resulted this change. Further, the growth in Area under Cultivation of food

grains pulse (0.82%) was having highest than cereals (0.41%). However, in case of Area under Non-Food Crops, groundnut (-0.47%) and linseed (-3.84%) have registered negative growth trends when compared to other non food crops. The reason for decline might be non availability of quality seeds and disease resistant varieties for regional requirements. On the other hand, Rapeseed & Mustard was observed growth of 2.68% ranking as highest among all the non food crops followed by coconut (1.78%) and castor (1.36%) were the three major non food crops growth over a period during the study.

Table.01 Growth trends in Land Use pattern in India (1962-2021)

Sl.No.	Particulars	Parameters	CGAR
1	Pattern of Land Use	Net Sown Area	0.07 %
		Gross Sown Area	0.44 %
		Net Irrigated Area	1.74%
		Gross Irrigated Area	2.13%
2	Area under Cultivation of food grains	Cereals	0.41%
		Pulses	0.82%
		Total food grains	0.49%
3	Area under Non-Food Crops	Groundnut	-0.47%
		Castors	1.36%
		Sesamum	0.11%
		Rapeseed & Mustard	2.68%
		Linseed	-3.84%
		Coconut	1.78%
		others	4.91%
		Total	1.40%

Cropping pattern plays important role in maintaining soil fertility, increasing yield and best use of nutrients. Depletion of specific nutrients in the soil is observed when long term planting of the same crop type is done. Nutrient interaction with the soil is different for different crops, hence diversification is best use of soil nutrient exchange and absorb nutrients of different types present in soils. Because of this, crop diversification helps in controlling deficient or excess nutrients and also increases the soil fertility by absorb abundance nutrients present in the soil. Some scientific studies evidence reveals that, about 10 to 25% increase in crop yield in crop diversification rather than monoculture. In this context the study aims to analyze the cropping intensity of different states in India, the results are presented in table.02 which shows that, Andhra Pradesh and Kerala have negative growth when compared to Karnataka and Tamil nadu states. In case of northern states, comparatively Delhi and Madhya Pradesh shows the high positive growth when compared to other northern states in India.

Table.02 Comparative status of Cropping Intensity of southern and northern states of India

Sl.No.	States/UTs	2010-11	2019-20201	% Change
	Southern states			
1	Andhra Pradesh	129.7	123.8	-0.045
2	Karnataka	124.1	128	0.031
3	Kerala	127.8	127.6	-0.002
4	Tamil Nadu	116.1	125.4	0.080
Northern States				
5	Bihar	136.8	143.7	0.050
6	Chhattisgarh	120.8	123.7	0.024

7	Delhi	200.9	265	0.319
8	Haryana	184.9	186.3	0.008
9	Jharkhand	115.1	136.3	0.184
10	Madhya Pradesh	145.8	182.3	0.250
11	Punjab	189.6	189.9	0.002
12	Rajasthan	141.7	152.6	0.077
13	Uttar Pradesh	154.4	162	0.049
14	India	139.6	142.31	0.019

The term "non-forest purpose" means the breaking up or clearing of any forest land or portion thereof for- (a) the cultivation of tea, coffee, spices, rubber, palms, oil-bearing plants, horticultural crops or medicinal plants; (b) any purpose other than re-forestation; but does not include any work. Hence the study focus to know the important areas of non-forest purpose Approved for Use of Land. The results are presented in table03. It shows that, Defence (1287.69), followed by Pipeline (416%) , Sub Station (249%), Industry (245%) and Drinking Water (118%) were the major Area Approved for Use of Land for Non-forestry Purpose.

Table.03 Category-wise Area Approved for Use of Land for Non-forestry Purpose under Forest (Conservation) Act, 1980 in India (2019 to 2021)

Category	2019-2020	2020-2021	% Change
Approach Access	12.35	30.55	147.37
Defence	187.44	2601.08	1287.69
Drinking Water	234.92	513.78	118.70
Hydel	4633.78	593.49	-87.19
Industry	12.51	43.27	245.88
Irrigation	2813.77	1542.04	-45.20
Mining	3413.84	2393.62	-29.88
Optical Fibre Cable	91.47	121.67	33.02
Others	1276.89	1430.45	12.03
Pipeline	18.67	96.43	416.50
Quarrying	6.69	2.59	-61.29
Railway	612.87	1049.79	71.29
Road	2655.95	5267.18	98.32
School	0.18	0.03	-83.33
Sub Station	12.98	45.42	249.92
Thermal	46.51	38.1	-18.08
Transmission Line	1484.7	2281.76	53.68
Village Electricity	11.92	3.19	-73.24
Grand Total	17528.69	18314.23	4.48

Conclusion

Natural resource plays an important role in the economy of a country. To have a good economy following the suitable resource management and also cropping patterns is important, and the agriculture is influenced by climate and it is affected by various biotic and abiotic factors. Thus we can conclude that better land use policy decisions will play a major role in the determination of the land use planning in Indian agriculture.

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Synergistic effect of Yemini Sidr and Manuka honey against MRSA Biofilm**Mohammad Javed Ansari¹, Ahmad Al-Ghamdi², G. K. Sharma¹**¹*Department of Botany, Hindu College Moradabad, MJP Rohilkhand University-India*²*Bee Research Chair, Department of Plant Protection, College of Food and Agricultural Sciences, King Saud University, Riyadh, Saudi Arabia***Purpose**

Antimicrobial resistance (AMR) is a critical health issue today. Over several decades, to varying degrees, bacteria causing common infections have developed resistance to each new antibiotic, and AMR has evolved to become a worldwide health threat. Due to increasing development of resistance by microorganisms, numerous studies have been conducted to find new alternative sources of antimicrobial agents, especially from natural sources. Honey is an ancient remedy that has recently been introduced into modern clinical practice in developed countries. The aims of this project were to examine the antimicrobial properties of yemini sidr and Manuka honey against various Gram-positive and Gram-negative bacterial strain including MRSA.

Methods

Agar well diffusion assays, minimal inhibitory concentration (MIC), minimal bactericidal concentration (MBC), fractional inhibitory concentration (FIC) index, scanning electron microscopy (SEM) and Time-kill assay were used to check the antimicrobial and synergistic effect of both honeys.

Results

Values Inhibition zones ranged from 9.52 to 17.50 mm and 07.19 to 15.9 mm respectively for sidr and Manuka honey. The MIC value of both honey decreased significantly when mixed together and showed synergistic effect as interpreted by Checkerboard fractional inhibitory concentration (FIC) index. SEM images showed that the number of cells decreased significantly on the established biofilm of MRSA, when treated with both honey alone and/or in combination as compared to biofilm treated with artificial honey. Here we demonstrated that bacterial pathogens and MRSA biofilm are susceptible to sub inhibitory concentrations of sidr and Manuka honey alone and in combination.

Conclusions

Combination of the sidr and manuka honeys could lead to the development of new broad-spectrum antimicrobials that have the potential to prevent the emergence of resistant bacterial strains and could be a valuable antimicrobial agent for management of infections caused by these organisms

Keywords: Antimicrobial resistance; Sidr Honey; Manuka honey; antimicrobial activity; MRSA; Biofilm

Tectona grandis* (Linn. F) Plantation in Agricultural Landscapes: An Investment for Climate Resilience*Gopal Shukla, Roman Chettri, N. N. Shahina, Manendra Singh, and Sumit Chakravarty**
*Department of Forestry, Uttar Banga Krishi Viswavidyalaya, Pundibari, Cooch Behar, 736165, West Bengal, India***Purpose**

The potential of Trees outside Forests to store large quantities of carbon needs to be assessed and monitored properly for which local, regional or national inventory is required. Many studies on the quantification of understory vegetation diversity, biomass and carbon storage potentials of various tree species have been carried out, but studies on Teak in agricultural landscapes in the sub-Himalayan region are lacking.

Methods

The present work was conducted from September 2018 to February 2020 in randomly selected young unmanaged teak farm forestry plantations categorized into ≤ 5 , 5-10 and 10-15 years age classes. In a plantation, 10 % of the teak trees were randomly selected, while all other trees other than teak were selected. A stratified random nested quadrat sampling method was adopted for analysing other vegetation forms within a plantation. Ecosystem carbon storage is estimated by the summation of biomass, soil and litter carbon present in the system.

Results

Overall species richness of the plantations was 28, of which 11 were trees, nine herbs, three each of shrubs and climbers and two ferns. Based on IVI values, herbs were the most important species followed by shrubs and trees. With the increasing age of the plantation, the richness of plant species decreased and so were the vegetative parameters and diversity indices. Soil physicochemical properties were significantly influenced by the plantation age but exhibited no discrete trend. Total biomass density and total carbon density increased with increasing plantation age while no drastic variation was observed for available SOC as litter production did not vary much with increasing plantation age. The overall mean total plant biomass, total available SOC and ecosystem carbon in the plantations was 83.1, 39.63 and 81.18 Mg ha⁻¹, respectively.

Conclusion

Farm forestry plantations are now globally recognised as low-cost viable options to supplement forests for offsetting carbon emissions. Promoting plantations of suitable site-specific tree species in less or unproductive and degraded agricultural lands are effective management action for offsetting terrestrial C emission. Managing soil and biomass C in an agricultural landscape by promoting *Tectona grandis* or any other tree species plantation will both be an avoided emission and net addition of C to terrestrial pool thereby fulfilling the global 4 per mille initiative

Keywords: Plant diversity, Soil carbon, Biomass, Ecosystem carbon

Standardization of a protocol for direct regeneration from cotyledons, root and leaf of *Citrus jambhiri* Lush.

Priyanka Sharma, Bidhan Roy and Monish Roy

Department of Plant Breeding and Genetics Assam Agricultural University, Jorhat-13,

Purpose

Direct regeneration of plantlets from somatic tissues hold extreme importance as it produces true-to-type plantlets. To date, direct organogenesis from leaf explants of *C. jambhiri* is very limited. Hence, in our experiment, effort was taken to standardize the protocol for direct regeneration of plantlets from cotyledon, root and leaf of *C. jambhiri*. In addition, this method of propagation would aid in further conservation of endangered plant species.

Methods

For the preparation of MS medium, exact quantities of all the components of particular medium were mixed. 3% sucrose was added and final volume of the medium (1.00 L) was made by the addition of double distilled water. The pH of the medium was adjusted to 5.8 using 1N HCl or 1N NaOH. Medium was solidified with 0.8% agar. The MS medium was stirred and heated on hot plate magnetic stirrer to melt the agar. The medium was then autoclaved at 15 psi for 15 minutes at 121°C. The medium was then poured into the culture bottles being under the laminar air flow cabinet. For direct regeneration of roots, surface sterilized seeds were inoculated on MS medium added with different concentrations and combinations of IAA and IBA. Cultures were then incubated in the culture room at 25±2 °C with 16/8 h light and dark phases for six weeks. Treatments that were used for conducting the experiment includes (i) MS + Casein hydrolysate at varying concentrations of 50, 100 and 200 mg/L; (ii) MS+IAA (1.0 mg/L) (iii) MS+ IBA (1.0 mg/L) (iv) MS+IAA (1.0 mg/L)+IBA (1.0 mg/L) (v) MS+BAP (1.0 mg/L).

Results

Direct regeneration of plantlets of *Citrus jambhiri* Lush. were obtained from cotyledons, roots and leaves. Most of the cotyledon (96%) enlarged on medium supplemented with 50 mg/L of casein hydrolysate. Few of those enlarged cotyledons responded to direct regeneration of shoots. Maximum shoot per responded cotyledon was 32. Conversely, the health of the plantlets was poor with semi-cylindrical leaves. Most of them dried on maintenance medium or on rooting medium and died. Plantlets regenerated on medium supplemented with IAA in combination with IBA were healthy and they established on maintenance medium and rooted on rooting medium. Direct regeneration was also obtained from leaf on MS medium supplemented with 0.50 mg/L of dicamba.

Conclusions

Among all the treatments followed for enlargement of the cotyledons, it was observed that the best performance (96%) was obtained from the seeds treated with casein hydrolysate at a concentration of 50 mg^{-L}. Healthy plantlets were regenerated from the medium containing IAA combined with IBA. In terms of regeneration from the leaf segments, it was observed that explants treated with 0.50 mg^{-L} supplemented MS medium resulted with highest regeneration potential.

Keywords: Direct regeneration, Rough lemon, Casien hydrolysate, Cotyledon, Root, Leaf

***Chenopodium album* mediated synthesis of reduced graphene oxide nanoparticles and its antimicrobial and anticancer activity**

Faizan Ahmad

Department of Post Harvest Engineering and Technology, Faculty of Agricultural Sciences, Aligarh Muslim University, Aligarh, UP-202002, INDIA

Purpose

Chenopodium album is a green leafy vegetable with high-water content which results in their shorter shelf life. It cannot be preserved for a longer duration, and it goes as a waste product, so liquid extraction of *Chenopodium album* can be stored and used as a reducing agent as well as a stabilizing agent. *Chenopodium album* is an excellent source of high-grade vitamins, proteins, nutrients and antioxidant predominantly retinol and ascorbic acid. This study developed a novel method of preparing reduced graphene oxide (RGOX) from graphene oxide (GOX), employing vegetable extract, *Chenopodium album*, as a reducing and stabilizing agent.

Methods

The modified 'Hummer's method' has been used for the preparation of GOX by using precursor graphite powder. During this study, the green synthesis of RGOX was functionally characterized by employing FTIR and UV-visible spectroscopy, SEM, and TEM.

Results

The results of the study showed the typical morphology of RGOX stacked in silky, transparent, and rippled layers. The antibacterial activity was shown by analysing minimal inhibitory concentration values, agar diffusion assay, and fluorescence techniques. It showed enhanced antibacterial activity against Gram-positive and Gram-negative bacteria compared to GOX. It has also been demonstrated that the synthesized compound exhibited enhanced anti-biofilm activity as compared to its parent compound.

Conclusions

The present study is the first to report this green, simple, facile and cost-effective procedure for direct reduction of GOX using *Chenopodium album* leaves extract. The overall results of the experiments prove that *C. album* leaves extract is an important alternative to the traditional chemical reduction method to avoid chemical intervention. The activity of GOX and RGOX against bacteria and fungi has been demonstrated. It was found that RGOX showed an

increased antibacterial (Gram-positive and Gram-negative) and antibiofilm activity as compared to GOX. The efficacy of RGOX and GOX has been demonstrated on a human breast cancer cell line, which suggested RGOX as a potential anticancer agent.

Keywords: *Chenopodium album*; anticancer; antimicrobial; graphene oxide; graphite powder; reduced graphene oxide.

Response of soil microbiome to amendment with ZnO nanoparticles and Zinc biofertilizer in wheat rhizosphere

Shams Tabrez Khan and Shaibi Saleem

Department of Agricultural Microbiology, Faculty of Agricultural Sciences, Aligarh Muslim University, Aligarh 202002, U.P., India, shamsalig75@gmail.com

Purpose

Zinc is an important micronutrient for plant growth and reproduction. Its deficiency in soil or availability in insoluble forms not only limits plant growth but also causes Zn deficiency in higher trophic levels, especially in humans incurring significant losses. The impact is so significant that World Health Organization is recommending Zn fortification of the diet. ZnO nanoparticles often perceived as soil pollutants can be used as a source of Zn in combination with Zn biofertilizer for agronomic fortification of wheat grains. We have addressed in this study the feasibility of this approach especially focusing on the microbiome associated with the wheat rhizosphere.

Methods

The Zn biofertilizer (20g Kg⁻¹) prepared in this study was coated on the seeds of wheat (*Triticum aestivum* variety PBW343) and standard doses of NPK and ZnO nanoparticles (5kg ha⁻¹) were added to the soil. Soil samples from the wheat rhizosphere were collected after 120 days of sowing. The collected samples were subjected to genomic DNA preparation and the isolated DNA was used as a template for amplification of the 16 S rRNA V3-V4 region for subsequent Illumina sequencing. Standard bioinformatics analysis using qiime2, and R packages vegan, microeco packages were used for the analysis of the reads. Part of the samples were serially diluted and were spread on various culture mediums including nitrogen-free medium, phosphate solubilization medium, and medium for total aerobic bacteria, fungi, and actinomycetes.

Results

In the presence of ZnO NPs and Zn biofertilizer, the vegetative growth and grain yield of the wheat plant improved significantly. Interestingly alpha diversity and beta diversity indices show no significant change in the microbial community structure of the wheat rhizosphere. Which was also confirmed by the absence of differentially abundant genera. However, the heat map shows an increased population of certain genera like *Rhizobium*, *Bacillus*, and *Masillia* indicating enrichment of plant growth promoting rhizobia. Culture-based studies also show an increase in the population of Phosphate solubilizers and Zn solubilizing bacteria indicating a successful survival of inoculated biofertilizer.

Conclusions

Our studies strongly suggest and recommend the use of ZnO NPs along with the Zn biofertilizer for agronomic fortification of Zn as a significant improvement in plant growth parameters was observed with no significant influence on soil rhizobial microbial community structure.

Keywords: Zn biofertilizer, Illumina sequencing, soil microbial community, ZnO nanoparticles.

Robust NIRS models for non-destructive prediction of physicochemical properties and ageing of basmati rice**Patil Rajvardhan Kiran, Abhijit kar, Rabi Narayan Sahoo, Arunkumar T. V.***Division of Agricultural Engineering, IARI, New Delhi, 110012***Purpose**

Nowadays selling fresh rice instead of aged rice by traders is today's main constraint in the market. So, real-time authentication of rice is required to get guaranteed aged rice by consumers. But at present only destructive physicochemical methods are available for determining the age of rice which are complex, labor-intensive, and time-consuming. Due to the lack of information on determining the rice age by simple, quick, non-destructive, and readily adaptable methods current experiment was conducted.

Methods

A study was undertaken to explore the possibility of differentiating the aging process of rice during accelerated aging at 42.6°C temperature & 71% RH for a duration of 30 days. Changes in four physicochemical properties namely amylose content, volume expansion ratio (VER), water absorption ratio (WAR), and kernel elongation ratio (KER) were evaluated destructively (by spectrophotometer and cooking method) and non-destructively (by spectroradiometer) at every alternate day, during 30 days storage.

Results

The physicochemical parameters of rice showed a good correlation with spectral signatures. Subsequently, Principal component Analysis (PCA), Partial Least Square Regression (PLSR), and Multiple Linear Regression (MLR) were used to model the physicochemical changes occurring during the process of accelerated aging using spectral reflectance values. Based on values of Coefficient of determination (R^2) and Root mean square error (RMSE) accuracy of models was determined. Predictions with the MLR model resulted in a coefficient of determination (R^2) of 0.82, 0.87, 0.97, 0.83 and 0.82 with root mean square error (RMSE) of 0.18, 0.13, 0.21, 0.124 and 4.2 for amylose content, VER, WAR, KER, and ageing process respectively for calibration. The study demonstrated the potential of NIRS in non-destructively predicting the physiochemical parameters of rice.

Conclusion

Changes in the physicochemical properties (amylose content, volume expansion ratio, water absorption ratio, and kernel elongation ratio) at all intervals of accelerated storage were analyzed destructively and non-destructively. Raw spectral reflectance as well as its first derivatives of reflectance were correlated with the physicochemical parameters and accelerated aging periods to identify the suitable spectral bandwidth which could be utilized to predict the age as well as the associated physical parameters of rice. Principal component analysis (PCA), Partial Least Square Regression (PLSR), and Multiple Linear Regression (MLR) were also used to develop suitable models which could predict the variability in aging as well as the physicochemical parameters.

Spectral reflectance can effectively capture the changes in the amylose content, VER, WAR, and KER during the accelerated aging of rice. The spectral reflectance values can also be effectively used to determine the time of accelerated aging of rice.

The variabilities in the physical parameters as well as aging could be defined within 600 to 1800 nm using raw values of acquired spectral reflectance. While using the 1st derivative of the acquired spectral reflectance values narrowed down the wavelength range between 900 to 1350 nm.

MLR models could predict all four physical parameters as well as the accelerated age of rice using acquired spectral reflectance values ($R^2 > 0.80$) compared to PSLR models ($R^2 - 0.42$ to 0.77).

Keywords: Accelerated Ageing; Basmati rice; Non-destructive; Reflectance; Robust; Spectroradiometer.

Problems faced by rural-urban migrated adult children: A study from Bagalkot district
Ashwini V Yankati

Department of Human Development and Family Studies, College of Community Science, UAS, Dharwad.

Purpose

People migrated in a larger number from rural to urban areas to different places. As many of adult children from rural areas are dependent on agricultural base that does not provide employment to all people living in villages. Due to migration from rural to urban areas in search of opportunities for jobs, good wages, natural disaster etc. Thus, paper explores to know the problems faced by adult children living Bagalkot district.

Methods

The total 100 participants were selected for research. The families were interviewed with using structured open-ended questionnaire. The information was collected from secondary data.

Results

The results showed that majority of adult children i.e., 68.0% of them belongs to age group 20-25yrs, 55.0% of adult children belongs to joint families and majority of adult children (54.0%) had upper primary education. The results also revealed that nearly 40.0% of adult children had faced problem due to unemployment, 38.0% of due to low wages for labour work, 32.0% children went due to better job opportunities, 19.0% of children migrated due to natural disaster and only 11.0% of migrated due to poor facilities. The results also showed that 70.0% of adult children migrated temporary and 30.0% of them were permanent migrated. The economic support to families like 56.0% children supports financially to elderly parents, 45/0% of children send money to children education, 54.0% of them sends the money for elderly parent's health and other medical appliances, 28.0% of them spend money on home construction/furniture

Conclusions

Hence, the adult children migrated to urban areas to raise and keep family safe.

Keywords: *Problems, Migration, Rural, Urban, Families*

EXTENT AND PATTERN OF OCCURENCE OF LAC HOST AND LAC INSECT RESOURCES IN ARID WESTERN PLAINS OF INDIA

Hemant Swami*, Sheenam Bhateja and M.K. Mahla

Department of Entomology, RCA, MPUAT, Udaipur, 313001

Purpose

The Lac insect, *Kerria lacca* (Kerr) is a unique insect of economic importance producing the natural resin of wide use. It secretes resin in the form of lac to protect its body and is found throughout the world in different agro-climatic conditions on wide range of host plant. India is the global leader in lac production and contributes about 85 percent of world lac production. Lac occurs in most parts of India but mainly cultivated in Jharkhand, Chhattisgarh, Madhya Pradesh, Maharashtra, Odisha, West Bengal, Rajasthan, Gujarat and parts of some other states (Yogi *et al.*, 2018). The major host plants of *K. lacca* include bargad, palas, kusum, ber, peepal, red gram and *Flemingia semialata* (Monobrullah *et al.*, 2016). However, natural lac insect in various parts of Arid Western Plains occurrence is reported thought out the state with number of specific host plants. Presence of lac insect on different host plants are sign of favourable climatic condition for the natural occurrence of lac insect/ host plants. There is lack of awareness among local people about the existence of lac insect genetic resources on these host trees and ignorantly, the natural habitat of lac insects of the region is destroyed. Host plants/

lac insects recorded from this region will help to promote lac culture in other areas as well as biodiversity of lac insect species will remain conserved and maintained. The present field study was carried out with the intent to record the lac insect occurrence and also to record the new or potential host plants during 2021-22 under NPCLIGR.

Method

In the present study block wise survey were conducted in total 30 districts of Arid Western Plains of three states of Rajasthan, Haryana and Gujarat of the country. The field surveys were conducted in 84 blocks of 30 districts of these three states during June-July, 2022 to document occurrence of lac insect under the ICAR funded “Network Project on Conservation of Lac Insect Genetic Resources”. All districts were surveyed to identify natural occurrence sites, with documentation of block wise occurrence, colour variation and lac encrustation on host plants. Information was also taken from traders and farmers at block level. The lac insect populations were located through visual observations and through binoculars, especially on reported lac host species. If lac insects were noticed, then the branches having the lac insect were collected by using secateurs and tree pruner, kept in the 60 mesh net and labelling.

Result

The findings of the survey reveals that the presence of lac was recorded prevail in the region among the 21 different host plants viz.; *Acacia auriculiformis*, *A. lebeck*, *A. reticulate*, *A. senegal*, *Butea monosperma*, *Calliandra calothyrsus*, *Dalbergia sissoo*, *Delonix regia*, *Ficus religiosa*, *F. benghalensis*, *F. palmata*, *F. racemosa*, *F. benjamina*, *F. tsiela*, *Peltophorum ferrugineum*, *Pithecellobium dulce*, *Polyalthia longifolia*, *Prosopis cineraria*, *P. juliflora*, *Samanea saman*, and *Ziziphus mauritiana* in the vicinity of the human beings. Total 84 Blocks of 30 districts of these three states were surveyed, in which 29 blocks of 7 districts of Rajasthan, 29 blocks of 11 districts of Haryana and 26 blocks of 12 districts of Gujarat were surveyed, respectively. During survey prevalence of lac insect was noticed 142 locations of which a total of 09 host were identified as natural host for natural prevalence of the lac insect in the region during 2022. It was noticed that at majority of locations lac insect was recorded on Peepal, Ber, Babool, Bargad, Palas, Custard apple, Sheesam, Siras and Keekar out of 142 locations covered with 74 live and 68 dead samples.

Conclusion

Based on the findings, it has been realized that the natural occurrence of Lac was recorded on era of host plants in the vast area of Rajasthan, Haryana and Gujarat region are bestowed with ample population of lac insect and its host plants viz., Peepal, Ber, Bargad and Palas. There is an alarming need to conserve and augment the biological diversity of lac insect of the country through mass awareness programmes among the common people.

Keywords: Survey, Host Plants, Lac Insect, Arid Western Plains

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Management Of Tomato Fruit Borer, *Helicoverpa Armigera* Through Bio Intensive Pest Management Module In Tomato Ecosystem

M.K. Mahla, Hemant Swami, Anil K Vyas

Department of Entomology, RCA, MPUAT, Udaipur (Raj.)

INTRODUCTION

Tomato is a highly perishable fruit crop attacked by a number of insect pests. The tomato fruit borer *Helicoverpa armigera* is the major insect pest among the pests infesting tomato. It attacks fruits and makes it unfit for human consumption causing considerable crop loss upto 55 per cent in yield. Indiscriminate and injudicious use of chemical pesticides leads to the outbreak of secondary pests, development of insecticide resistance including resurgence which ultimately affects the plant and soil ecosystem. The increasing concern for environmental pollution has evoked a worldwide interest in the Bio intensive pest management, which can protect the crop in a ecofriendly manner.

Vegetables are the most essential component of the Indian diet and India is the world's second

Method

The experiment were conducted at Farmer's field, at Madar and Brahamno ki Hundar (Badgaon) over an area of 2.0 ha for each treatment during 2020-21 and 2021-22 for two consecutive crop seasons to evaluate the efficacy of the BIPM module against tomato fruit borer. The BIPM module comprised of Seed treatment with *Trichoderma harzianum* @ 10g/kg of seeds, spray of Azadirachtin 1500 ppm @ 2 ml/lit, *Beauveria bassiana* @ 1×10^8 conidia /gm, @ 5g/lit, Spray of HaNPV (1.5×10^{12} POBS/ha), *Bacillus thuringiensis* @ 1kg/ha-1, against *Helicoverpa armigera*. . The module was evaluated in comparison with chemical control (spray of Spinosad 45 SC @ 0.25 ml/l) and untreated check in the farmers' field. Observations were recorded on larvae/ plants, fruit damage (%) and fruit yield (t/ha).

Result

The experiment were conducted in Rabi, 2020-21 and 2021-22 at farmers field to record the incidence of *Helicoverpa armigera*. The results reveal that no significant difference was observed between BIPM package and chemical control with regard to the parameters viz., number of *H. armigera* larvae/plant and fruit damage. BIPM package was equally effective as chemical control against *H. armigera*. Chemical control module recorded the highest yield (14.77 t/ha) which was at par with the yield recorded in BIPM package (13.59 t/ha). Significantly, low fruit yield was recorded in untreated control (8.73 t/ha).

Conclusion

It could be concluded that BIPM package had promising results in minimizing the pest damage with higher yield. Use of BIPM packages by the farmer will result in less use of pesticide which will be safer for the environment and human health.

Keywords: Tomato, BIPM, *Helicoverpa armigera*, Bio- pesticides

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Perception and Adaptability of cotton growers towards climate variability”**P.R.Deshmukh , R.P.Kadam and P.S.Kapse***Department of Agril. Extension Education , CoA,VNMKV,Parbhani (MS)***Purpose**

Climate variability refers to the variations in the mean state of the climate and variations in other parameters (such as the occurrence of extremes) on all temporal and spatial scales beyond that of individual weather events. However, Cotton crop is mostly grown in Marathwada region. The Maharashtra state is contributing 22.70 per cent of total production in the country. Area under cotton crop in Maharashtra state 41.92 lakh hectares with production of 85.00 lakh bales and productivity 345 kg per hectare in year 2022 (Source: Press Information Bureau–2022). In Beed district, total area under cotton is 3,32,005 hectare out of 8,76,000 hectares of total cultivable area. The present study was conducted in 2022-23 for Beed district of Marathwada region of Maharashtra which was purposively selected for the study.

Methods

The study was conducted in ten villages selected from two taluks namely Beed and Georai, which included 10 farmers from each of the selected villages. A sample of 100 farmers was selected for the study. Ex-post facto research design was used in the study.

Results

The analysis of profile of the cotton growers indicates that majority of them were belonged to middle age, read up to twelvth, medium family size, medium farming experience, small sized landholding farmers, medium annual income, medium extension contact, medium source of information , medium credit and subsidy orientation medium risk orientation. Majority of the respondents had medium level of perception followed by high and low level of perception on climate variability. Further it could observe that majority of the respondents had medium level of adaptability followed by high and low level of adaptability. The correlation analysis indicated that the profile of the cotton growers namely Education, Annual income, Extension contact, Source of information, Credit and Subsidy orientation found to be have positive and highly significant relationship with perception of cotton growers towards climate variability. While Age, Farming experience, Land holding and Risk orientation found to be have positive and significant relationship with cotton growers towards climate variability at 0.01 percent probability, Whereas variables like, Annual income, Credit and Subsidy orientation found to be have positive and highly significant relationship with adaptability of cotton growers to climate variability. While Age, Education, Farming experience, Land holding, Extension contact, Source of information and Risk orientation found to be have positive and significant relationship with adaptability of cotton growers to climate variability at 0.01 percent probability Problems expressed by the farmers were price fluctuation in the market after crop production, Non availability of short duration varieties suitable for escaping the terminal drought, high incidence of diseases. Suggestions elicited by the farmers were fixing of minimum support price by the government as the first one. Followed by evolving the varieties which can escape the terminal drought in groundnut, red gram and cotton and resistant to pest and diseases.

Conclusion

More awareness may be created among the farming community on available of varieties which can tolerant to pest and diseases, training may be given to farmers and extension officials on techniques of crop production and adaptation options to address various issues in climate variability. Arrangement for availability of credit and subsidy by the government.

Keywords : Perception, adaptability, cotton growers, climate variability

Floral visitors on parental lines of sunflower hybrid (kbsH-44)**Sanganna m. Sajjanar*, prabhuraj a.***University of Agricultural Sciences, Raichur-584104***Abstract**

The study was conducted at Main Agricultural Research Station, UAS, Raichur during rabi-2020-21 to record the floral visitors on parental lines of sunflower hybrid KBSH-44. Totally, thirty species of floral visitors were recorded on parental lines of sunflower hybrid (KBSH-44), among them 15 were hymenopterans, 7 lepidopterans, 5 coleopterans and 3 dipterans. Fertility restorer line (RHA 95C-1) attract more number of floral visitors for collection of both pollen and nectar compared to the cytoplasmic male sterile line (CMS 17A) visited by only nectar collecting floral visitors.

Purpose

Honey bees are the most important insect pollinators of cultivated crops worldwide. While some insects visit the flowers of only a small number of plant species. Honey bees will visit all flower from which they can harvest reward. Honey bees are one of the few pollinating insects that can be managed. They can be delivered to a crop when required and various management options available to influence the honey bees flower visiting behavior (Anonymous, 2012). The species richness and foraging behavior of honey bees on sunflower is genotype specific and is influenced by morphometric variations of the plant, which includes flower shape, flower structure, head size, floret length, corolla length, stigma pigmentation and many other factors. Whereas, nectar and pollen are the source of food for honeybees, which attract or restrict bee visitation to the host plant (Rinku *et al.*, 2017). The present study aims to record the floral visitor on parental lines of sunflower hybrid (KBSH-44).

Methods

The present investigation on “floral visitors on parental lines of sunflower hybrid KBSH-78” was carried out during 2020-21 at Main Agricultural Research Station, UAS, Raichur.

Diversity of flower visitors on parental lines of sunflower hybrid: Representative samples of flower visitors were collected by various methods of collection *viz.*, visual scanning, sweep net sampling and bee bowls as per the methodology suggested by Belavadi and Ganeshiah (2013).

Results

Floral visitors of parental lines of sunflower hybrid: The parental lines of sunflower hybrid KBSH-44 are visited by 15 species of floral visitors from five families of Hymenoptera, seven species from four families of Lepidoptera, five species from three families of Coleoptera and each one species from three families of Diptera (Table 1). Among the fifteen hymenopteran species recorded, ten species belonged to family Apidae, three species belonged to family Vespidae, two species each from family Halictidae and Megachilidae and one species to family Sphecidae. Order Lepidoptera was represented by three species under family Nymphalidae, two species from Erebididae and one species each represented under Pieridae and Spingidae. Order Coleoptera represented by two species each under family Chrysomelidae and Coccinellidae, one species under family Scarabaeidae. Order Diptera was represented by one species each under family Syrphidae, Sacrophagidae and Muscidae. The similar findings were reported by Jadhav *et al.* (2011) from Thirupathi, who recorded two families of Hymenoptera, four families of Lepidoptera and three families of Coleoptera and one family of Diptera visiting sunflower capitulum.

Table 1: List of floral visitors of parental lines of sunflower hybrid KBSH-44

Order	Family	Sl. No.	Scientific name
Hymenoptera	Apidae	1	<i>Apis dorsata</i> Fabricius
		2	<i>Apis cerana indica</i> Fabricius
		3	<i>Apis florea</i> Fabricius
		4	<i>Xylocopa aestuans</i> (Linnaeus)
		5	<i>Xylocopa fenestrata</i> (Fabricius)
		6	<i>Amegilla</i> sp.
		7	Unidentified
	Halictidae	8	<i>Lassooglossum</i> sp.
		9	Unidentified sp.
		10	<i>Vespa tropica</i> (Linnaeus)
	Vespidae	11	<i>Ropalidia marginata</i> (Lepeletier)
		12	<i>Polistes</i> sp.
		13	Unidentified sp.
	Sphecidae	14	<i>Megachile disjuncta</i> (Fabricius)
		15	<i>Megachile lanata</i> (Fabricius)
		16	Unidentified sp.
Lepidoptera	Sphingidae	17	<i>Danaus chrysippus</i> Linnaeus
		18	<i>Junonia lemonias</i> (Linnaeus)
		19	<i>Tirumala limniace</i> (Cramer)
		20	<i>Catopsilia</i> sp.
		21	<i>Amata passalis</i> (Fabricius)
		22	<i>Amata cyssea</i> (Stoll)
		23	<i>Gametis versicolor</i> (Fabricius)
	Coccinellidae	24	<i>Coccinella transversalis</i> Fabricius
		25	<i>Chilomenes sexmaculata</i> Fabricius
		26	<i>Monolepta</i> sp.
		27	<i>Leptisma</i> sp.
		28	<i>Eristalinus</i> sp.
Diptera	Syrphidae	29	Unidentified sp.
		30	Unidentified sp.

Conclusion

The fertility restorer line (RHA 95C-1) attract more number of floral visitor for collection of both pollen and nectar compared to the cytoplasmic male sterile line (CMS17A) will attract only nectar collection floral visitors.

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Impact of anthropogenic pressure on the soil macroarthropod diversity in a temperate forest, Kumaun Himalaya

Priya Bisht¹ and Chandra Singh Negi^{1*}

Ecology & Biodiversity Laboratory, Department of Zoology, M B Government Postgraduate College, Haldwani (Nainital)- 263139.

Purpose

Soil plays a significant role in forest ecosystem. Also soil macroarthropods are amongst the most important components of biodiversity in the forest ecosystems, and play significant role in the over-all soil nutrient dynamics. A comparative assessment of the soil macroarthropod diversity vis-à-vis changes in the soil physical properties consequence of the anthropogenic pressure was studied in two forest compartments differing in the intensity of the anthropogenic pressure.

Methods

The present study, undertaken in an old-growth temperate forest, and dominated by *Abies pindrow*, is situated in the Baling village, Darma valley, Kumaun Himalaya. The forest was divided into two segments depending upon the intensity of the anthropogenic pressure- a disturbed segment, denoted as Forest A, and the relatively intact segment, denoted as Forest B.

Results

Soil physical properties differed significantly between the two forest types, with the average soil moisture content being 42.20 ± 1.88 % and 62.05 ± 3.25 %, respectively between Forest A and B. Similarly, the average pH values ranged between 4.95 ± 0.04 and 6.27 ± 0.08 , respectively. As relates to soil macroarthropods, a total of 2871 individuals belonging to 5 different classes, 14 orders and 20 families were sampled from the two forests; with 1912 and 959 samples (abundance) collected from the two forests, respectively. However, there was no significant difference in species richness between the two forest segments.

Conclusions

The overall macroarthropods abundance was significantly correlated with soil moisture content and soil pH, in our study.

Keywords: Anthropogenic-pressure, biodiversity, macroarthropods, nutrient dynamics

Mapping Agricultural vulnerability of Maharashtra, India to climate change: A dynamic approach to take forward the vulnerability assessment methodology**S M Kavibharathi and Dr Sachin S More***Department of Agricultural Economics, VNMKV Parbhani, Maharashtra, 431402.***Purpose**

Vulnerability of a system is determined not only by the severity of climate change but also by the system's own sensitivity and adaptive capacity to cope with new change in climatic condition. This study while examining the agricultural vulnerability of Maharashtra State in India to climate change, tries to improve upon the vulnerability assessment methodology.

Methods

It chooses growth and instability of certain performance indicators to capture the relative vulnerability positioning of the districts of Maharashtra. The normalized indicators are assigned weights based on inverse of variance in each district with respect to the State. The weighted component indicators are then aggregated into a single index. In addition this study also categorizes the districts beyond ranking to have a meaningful characterization of the different stages of vulnerability and Mapped using Q-GIS.

Results

The present study found 6 out of 34 districts were highly vulnerable to the changing climatic conditions with Gadchiroli, Latur and Osmanabad having the highest degree of vulnerability.

Lowest adaptive capacity was found in district like Latur, Osmanabad, Beed, Jalna, Ahmednagar, Aurangabad, Solapur, Akola, Hingoli and Nanded reflecting the urgent need to strengthen the coping capacity in the districts by addressing decreasing growth in area and production of major crops.

Nashik, Kolhapur, Buldhana and Wardha to be the most exposed districts to climatic change followed by Ahmednagar, Aurangabad, Solapur and Akola.

Nanded, Chandrapur, Nagpur, Bandhara & Palghar to be the most sensitive districts to climatic change followed by Beed, Jalna and Sindhudurg

Conclusions

This study reveals the fact that all districts in an agro climatic zone does not fall under the same category of vulnerability which exemplifies the need for the State to prioritize research and development issues and effective decision making through "Location-Performance-Vulnerability" based adaptation strategies.

Keywords: Climate change, Vulnerability, Agriculture, Performance indicator.

Phosphomevalonate kinase regulates terpenoid production during mango fruit ripening.**Garima Pathak***Department of botany, B.D. College, Patliputra University, Patna-800001***Purpose**

Mango is a popular tropical fruit with a great diversity in taste and aroma, contributed primarily by terpenoids. Phosphomevalonate kinase (PMK) is a key enzyme for isoprenoid biosynthesis in the mevalonic acid (MVA) pathway responsible for terpenoids. We aim to understand the PMK gene and its function for further investigation into terpenoid production in mango.

Method

In this study, two cultivars of mango, "Dashehari" and "Banganpalli", showing opposite spatio-temporal patterns of ripening polarity, were investigated by q-PCR for studying the role of *MiPMK*

in aroma production. PMK kinetic activity was analysed with light spectroscopy. Further protein inactivation carried out using VIGS. Metabolic analysis of fruit pulp was done using GC-MS.

Results

MiPMK transcription and enzyme activity increased during ripening in both varieties. Expression in the early-ripening inner zones preceded that in the later-ripening outer zones of “Dashehari” while it was higher in the early ripening outer zones in “Banganpalli”. Polypeptide sequences of the two enzymes showed differences in a few amino acids that were also reflected in kinetic properties such as specific activity and pH optima. Silencing of *MiPMK* in “Dashehari” fruit by VIGS suppressed the kinase activity and led to changes in relative contributions of the mevalonic acid (MVA) and **methylethanolol 4-phosphate** (MEP) pathways.

Conclusion

The study shows that *MiPMK* levels may control downstream metabolite flux of the MVA pathway in mango.

Key words Aroma; Dashehari; phosphomevalonate kinase; mevalonic acid pathway; ripening; terpene; virus-induced gene silencing.

Economics Of Production, Marketing And Value Addition Of Soybean In Washim District Of Maharashtra

R. A. Patil, R. V. Shedge, R. R. Nirgude

Pgi, Mahatma Phule Krishi Vidyapeeth, Rahuri-413 722

Purpose

Soybean production is important to the economy of the country as most of the country's edible oil needs are satisfied through imports. The present study has been undertaken in Washim district of Maharashtra. The study would be valuable to the soybean producer by revealing the cost, return from the soybean cultivation. Accordingly, they can minimize the cost on unnecessary inputs. Also help producer to know the marketing structure of their produce and help them to know which marketing channel is most efficient for their produce. This study also involved the value addition in soybean, which is beneficial to soybean processing unit owner in identifying flaws in existing unit and implementing corrective action if needed. Objectives of study are,

- 1) To estimate the costs and returns of soybean cultivation.
- 2) To estimate the marketing costs, marketing margin and price spread of soybean.
- 3) To estimate the value addition in soybean.

Methods

Washim and Mangrulpir tehsils were selected on the basis of maximum acreage under soybean. Four villages from each tehsil were selected with highest acreage under soybean. Thus, from eight villages, 15 soybean growers were randomly selected from each village on the basis of total land holding further categorized into three different groups (five in each group) i.e. small (upto 1.00 ha), medium (1.21 to 2.00 ha) and large size group (2.01 ha and above). Thus, final sample comprised of 120 soybean growers. The primary data collected for the agriculture year 2020-21 was analyzed by using simple tabular approach and functional analysis method to satisfy the specific objectives as to estimate the costs and returns; to estimate the marketing costs, marketing margin and price spread; to estimate the value addition in soybean.

Results

At overall level, the per hectare cost of soybean cultivation (Cost 'C') was found to be ₹ 51860.98, while per quintal cost was observed to be ₹2742.52. At overall level B:C ratio at cost 'C' was 1.67. It clearly indicated that the soybean cultivation was a profitable venture. The per quintal cost was

observed to be minimum at large size farm (₹ 2742.52) and maximum for medium size group (₹ 2843.56).

The results of Cobb-Douglas production function showed that machine (X2), manures (X3), nitrogen (X4), phosphorus (X5), potassium (X6) were positive and significant influencing the yield of soybean. The soybean mill processed 11250 q of soybeans, yielding one main product as refined oil, and two by products viz., crude oil waste and de-oiled cake. The total cost of processing for a quintal of soybeans incurred by soybean mill owner was ₹4969.95. Gross return obtained from 1 quintal processed soybean was found to be ₹5702.70 where B: C ratio was 1.15 which indicate that soybean processing venture was beneficial. Break even quantity of soybean oil mill was 415.92 q, which was much below than actual quantity processed, means the processing plant have already covered all the expenses made initially.

Two marketing channels were identified, among which Channel-II: Producer-Wholesaler-Retailer-Consumer was mostly preferred by growers over Channel-I (Producer-Processor-Wholesaler-Retailer-Consumer). The average price spread for soybean was ₹2887.03 per quintal and ₹571.71 per quintal for Channel-I and Channel-II, respectively. The marketing efficiency for Channel-II was 5.37.

Conclusions

At the cost 'C' level, the B:C ratio for the sample soybean producers is more than unity, indicating that soybean is a profitable crop from the producer's standpoint. The B: C ratio of the soybean processing mill was 1.15, and the break-even quantity was 415.92, indicating that there is scope to increase soybean processing. Channel-II: Producer-Wholesaler-Retailer-Consumer was found to be beneficial from the viewpoint of the producer, as the producer's share of the consumer's rupee was the highest. Processors had the highest marketing costs, followed by retailers.

Keywords: Cost of cultivation, Marketing cost, Market margin, Producer's share of the consumer's rupee, Marketing channels, Soybean processing.

Development of empirical relationship between soil erosivity parameters using laboratory Simulated rainfall and Laser Precipitation Monitor

V. G. Jadhao, Ashish Pandey, and S. K. Mishra

Department of Water Resources Development & Management. Institute of Technology Roorkee-247667, INDIA

Purpose

The critical review of the literature indicated that a universal rainfall simulator does not exist, and the characterization of simulated rainfall parameters of any simulator is indispensable for further study. Therefore, the study sought to characterize simulated rain with a laboratory-scale pressurized nozzle-type rainfall simulator. The main objective of the present study was to analyze the rainfall parameters such as DSD, *KE*, and rain erosivity using simulated rain and an advanced Laser Precipitation Monitor comparable to natural rain. The study also focused on developing alternative empirical models to correlate the various rain parameters.

Methods

Six pressurized nozzles of different capacities were engaged with Laser Precipitation Monitor to generate various rain intensities (6.40 to 77.60 mm.h⁻¹) and register rain granulometry, respectively, in the laboratory study. A soil erosion flume of 3.125 m² with an adjustable longitudinal slope was used to investigate the sediment transportation induced by runoff at different slope gradients (0, 5, 10, & 15%) on sandy loam soil in the laboratory study. Empirical relationships were developed to correlate the rain and sediment yield parameters. The adequacy of

the developed relationships was validated for observed data from three different LULC (High dense, medium dense & Fallow) and slope gradients (8, 12 & 15%) in natural rain conditions. Multiple regression and ANOVA analysis have obtained higher retrieval accuracies for non-linear (logarithmic and power) relationships developed for sediment yield.

Results

All the nozzles efficiently operated at a pressure range from 0.4 to 1.2 kg.cm⁻² and showed a significant relationship between pressure and rain intensity. A 12 m height was sufficient for the raindrops (specially >3mm) to achieve their terminal velocities. The nozzles can have a wide range of rainfall intensities from 6.40 to 77.60mm/hr at a pressure range between 0.2 to 1.6 kg.cm⁻² and produce an average number of droplets ranging from 5985 to 48150 per minute. The median drop size (D_{50}) reduced with increased pressure and varied linearly with the rain velocity. Various power and exponential-law models correlating the D_{50} and rainfall intensity (I) were developed, yielding the best fit to the data ($R^2= 0.73$ to 0.96 , $p<0.0001$) with minimum MAE, MSE, and RMSE. The present study also developed a generalized form of the exponential-law model to relate D_{50} and I .

Various linear and non-linear models were developed for relating time-based kinetic energy (KE_{time}) and rainfall depth (volume) based kinetic energy (KE_{vol}) with rain intensity and yielded excellent fits ($R^2= 0.73$ to 0.94 , $p<0.0001$). The power-based and exponential models showed the best fit to the KE_{vol} - I data. The lower values of the MAE, MSE, and RMSE indicated a strong bond between the measured and estimated parameters.

Conclusions

The physical-based relationships developed between different rain and soil erosivity factors will be helpful in the estimation of various parameters with the mere measurement of the most common parameters. The developed models will be helpful for the assessment of median drop sizes, KE , erosivity, runoff, and sediment yield with the mere measurement of most common parameters such as rainfall intensity and rainfall depth from identical study area conditions.

Keywords: rainfall simulator, Optical disdrometer, drop size distribution, rain kinetic energy, soil erosivity

Extent of agricultural vulnerability to climate change in Maharashtra, India: A multidimensional approach

Athare Prakash Goraksha, Dharam Raj Singh

Division of Agricultural Economics

ICAR-Indian Agricultural Research Institute, 110012, New Delhi

Purpose

Climate variability and extremes are the alarming issues of the 21st century and addressing its impacts on agriculture is a special challenge. Literature on vulnerability assessment in Maharashtra across different regions and farm households are common, but multidimensional estimation with inclusion of crop production loss index has not been done hitherto. Therefore, an attempt has been made to develop an agriculture vulnerability index by considering the bio-physical, socio-economic, and institutional dimension of the vulnerability for districts of Maharashtra.

Methods

The potential crop production losses due to fluctuation in area and yield deviation were calculated to assess the effect of climate variations on crop production. By using a multidimensional approach suitable indicators have been selected under exposure, sensitivity, and adaptive capacity. After normalising the indicators weight were assigned to each indicator. For estimation of composite

vulnerability index, crop production loss index was also considered in addition to commonly used dimensions of vulnerability viz. exposure, sensitivity, and adaptive capacity. Further districts were categorised into high, moderate, and low based on degree of vulnerability.

Results

Yavatmal district is the most prone to climate change and reported as highest crop production loss index mainly due to cotton and oilseed production loss. The districts classified in high production loss categories are from Marathwada and Vidarbha region primarily due to lower rainfall and its variation. Sangali registered the most exposed and Jalgaon is the least exposed district to climate variation. As per, sensitivity index score Ahmednagar reported highest score, while lowest score was in Nagpur. In case of adaptive capacity, it was found that Pune had a highest score and lowest was in Sindhudurg. Overall composite vulnerability index score identifies Yavatmal, Latur, Ahmednagar, Beed, Sangali, Sindhudurg, Solapur are highly vulnerable districts.

Conclusion

It has been observed that the highly vulnerable districts show moderate to high degree of exposure and sensitivity to climate variations which makes them more vulnerable. It also highlights the importance of weather forecast for farmers and necessary adjustment to reduce the adverse impact of weather anomalies. In addition to this, to reduce the crop production loss crop planning in Maharashtra needs to be adjusted according to the climatic conditions in different regions.

Keywords: Crop production loss, Climate change, Maharashtra, Vulnerability

Comparative Economics Of Marketing Of Value Added Products Of Sorghum In Solapur District Of Maharashtra

R. V. Shedge, R. A. Patil, R. R. Nirgude

Pgi, Mahatma Phule Krishi Vidyapeeth, Rahuri-413 722

Purpose

Sorghum is a staple food for many people all over the world. Sorghum, is a low-cost source of energy, protein, iron and zinc among all grains and pulses. It is being produced for many purposes like food grains, *Hurda*, *Roties*, fodder etc. *Hurda* and *roties* are one of important products among them which are famous in Maharashtra. The present study which is carried out in Solapur district of Maharashtra would be helpful to the sorghum grower while deciding the purpose to grow it. The objectives were to ascertain the input use and estimate the costs and returns for sorghum production and value addition, to assess the marketing structure of sorghum value added products, to estimate the channel wise costs, margin, price spread and marketing efficiency.

Methods

The study was based on primary data of 30 sorghum growers, 10 *hurda* vendors, 15 *roti* vendors and 5 chaff fodder vendors. The tabular method was used to estimate cost of production, marketing cost, marketing margins and marketed surplus. The functional analysis was also carried out by fitting Cobb-Douglas type of production function.

Results

Cobb-Douglas production function was run for sorghum grain and R^2 was estimated to 0.55 and variables bullock power, seed, irrigation were positively significant and nitrogenous fertilizers were negatively significant. Cost 'C' for sorghum grain and roasted sorghum was calculated to D 40307.36 and D 26132.66, respectively. Cost of production of *hurda* incurred by vendors was D 178928.70. Per kg cost of production of *roti* was D 69.56 and that of chaff fodder was D 5.56. Per hectare sorghum grain production was 12.59 q and that of roasted sorghum was 12.11q. Average annual production of *roties* was 100692.67. Chaff fodder production was 673 tones. Sorghum grain

was being marketed through APMC's. *Hurda*, *Roti* and chaff fodder had no such market structure. These products were sold and marketed by producers themselves.

Conclusions

When sorghum grain and value added products were compared on the basis of kilograms, it was observed that, production of roasted sorghum (*hurda*) was the most profitable venture for the growers and net price realized was D 214.72 per kg of *hurda*. It was followed by sorghum bread (*roti*) with net receipts of D 107.99 per kg.

Keywords: Value added products, Marketing efficiency, comparative economics, Producer's share of the consumer's rupee, Marketing channels, price spread.

Effect of Nanofinish on Antibacterial Property of Cotton Fabric Sushila and Sarita Devi

Department of Fashion Design, FDDI, Noida, India

Purpose

Antimicrobial textiles based on eco-friendly natural agents have a great demand, which not only help to reduce effectively the ill effects associated with microbial growth on textile material but also comply with the statutory requirements imposed by regulating agencies. The study was carried out to investigate the effect of nanofinish on microbial resistance of cotton fabric.

Methods

The green synthesis was attained as per optimized concentration of the lemon plant extract and silver nitrate at optimized pH for optimized time. The nanofinish was given to the desized and scoured cotton fabric by pad dry cure method using 40°C temperature for 30 minutes. The ability of the nanofinish corresponding to antimicrobial activity as per AATCC-100 Test Method was studied.

Results

After application of nanofinish with 9 per cent concentration of silver nanoparticles synthesized from lemon plant extracts on cotton fabric with different dilution factors, lower microbial count was observed as compared to controlled (unfinished) fabric.

Conclusions

The nanofinish enhanced antimicrobial property of cotton fabric without affecting the inherent comfort nature of cotton fabric. Utilization of lemon plant parts for green synthesis of silver nanoparticles is a cost effective, simple and eco-friendly method that excludes the hazards arising out of use of harmful reducing/capping agents.

Keywords: Lemon, Cotton, Green synthesis, Nanofinish, eco-friendly.

Growth And Instability In Area, Production And Productivity of Major Pulse Crops In India**J. J. Rahane, V. A. Shinde, R. A. Patil,***PGI, Mahatma Phule Krishi Vidyapeeth, Rahuri-413 722***Purpose**

The share of agriculture sector in the country's GDP has been declining since independence from 55.1 per cent to 18.8 per cent in 2021-2022. The agriculture production is declined in Covid-19 period a rate of -2.7 per cent in country's as compared to pre Covid period. The growth in production and productivity of pulses has lagged behind the population growth rate which resulted in declines per capita availability of pulses from 60g/day/capita/ in 1951 to 45 g/day/capita in 2021, due to stagnant or decreasing crop production and rapid increase in population. In view, an attempt was made to examine the growth and instability in area, production and productivity of major pulse crops in India.

Methods

The study is based on time series data related to area, production and productivity of selected pulse crops for the period of 30 years from (1991-2021) which is divided in four period. Estimation of growth and instability in area, production and productivity by using Compound Growth Rate and Cuddy-Dell Valle Index respectively.

Results

There is positive growth trend in area, production and productivity in total pulses for all period except period I. Among the pulses, there is negative growth trend in area in horse gram for all period due to increase in productivity. For moth bean negative trend in area, production and productivity for period I & III due to climatic conditions. In black gram there is negative trend in area for period I & III.

Conclusions

There is negative growth rate in area and production under pulses for Period I. Instability for pulses is lower. Among the pulses, highest instability is recorded by moth bean in production is 78.73 per cent for II period.

Keywords: Growth Rate, Instability, Cuddy-Dell Valle Index, Area, Production and Productivity,

Yield maximization through sugarcane based intercropping systems**D.P. Pacharne, A.V. Attar and A.V. Solanke***Directorate of Extension Education, Mahatma Phule Krishi Vidyapeeth, Rahuri-413 722, Maharashtra, India***Purpose**

Farmer FIRST, Rashtriya Krushi Vikas Yojana (RKVY) project aims at enriching farmers-scientists interface for technology development and application. It will be helpful to spread university developed newly released varieties and recommendations through grant supplied by RKVY Project during 2015-16 to 2020-21. Frontline demonstration (FLD) is one of the most powerful tools of extension because farmers are driven by the perception that 'Seeing is believing'. The technology is to demonstrate under different agro-climatic regions and farming situations in ten districts. Irrigated area in Ahmednagar districts mainly adopted sugarcane monocropping systems which are facing the many problems like phytotoxic effects on rhizosphere, multiple ratooning in sugarcane caused water logging and salinization, weed infestation, reduction in physical and chemical properties of soil and also affect in the soil health. These are the major factors responsible for increasing the cost of cultivation and poor cane yield. There is urgent need to spread university developed intercropping technology in sugarcane which is helpful for increasing per ha yield and

beneficial to soil health. For this purpose, RKVY Project implemented through a front-line demonstration conducted during 2018-19 at Ahmednagar district (M.S.), to demonstrate newly released sugarcane based intercropping technologies and its management practices on the farmers field.

Methods

The FLD trial was conducted on farmers field in Hasanapur and Hanumantgaon village Rahatatahasil in Ahmednagar district, Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra. The soil of the experimental site is clay loam in texture (Clay- 47.45 %, Silt-34.21 % and Sand- 17.43 %) with having pH 8.2 and EC 0.29 dS/m and organic carbon 0.56 % in top of 15 cm soil. The soil available nitrogen, phosphorus and potassium were 178.11, 17.02, 423.0 kg/ ha and moderate in Fe, Mn, Zn and Cu were 6.59, 9.51, 0.62 and 3.41 $\mu\text{g g}^{-1}$ of soil. The average annual rainfall at Rahuri is 520 mm. The rainfall received from south-west monsoon from May to November was 693.8 mm and rainy days 43 during 2019, which is beneficial for crop growth and seed development. The average means annual maximum and minimum temperature ranges from 33° to 43°C and 6° to 18°C, respectively. The average relative humidity during morning and evening hours are 59 and 35 per cent, respectively. In pre-seasonal sugarcane were planted to intercropped with onion, potato and chickpea in month of 15th November in 100 Farmers Field. The adoption of sugarcane variety viz., CO-265 and CO-86032 with intercrops like onion (Phulesamart), Potato (Khupri Jyoti) and Chickpea (Digvijay). Every trial of Front Line Demonstration was conducted on 0.40 ha. The main crop of sugarcane was planted in 150 cm X 30 cm and intercrops of onion, potato and chickpea were sown on 15.0 x 7.5 cm and 45x15 cms, respectively. The application of fertilizer and plant protection measures were applied as per university recommendations. The crops will be harvested as per physiological maturity of inter crops and sugarcane. All information collected from selected farmers and data was recorded as per schedules prepared. At the end of experiment, it was analysed by proper statistical methods.

Results

The results indicated that, the three intercropping systems viz., sugarcane + potato, sugarcane + onion and sugarcane + chickpea were differed significant effect on farmers field. Among the inter cropping systems, sugarcane + potato recorded maximum growth and yield attributes main and intercrops which is beneficial to increase the sugarcane equivalent yield (191.5t ha^{-1}) than Sugarcane + onion (189.53t ha^{-1}) and sugarcane + chickpea (151.83t ha^{-1}). Similarly, It also recorded maximum productivity 32.96 % higher as compared to sole crop. Higher the economic yield of intercrops with good sales prices are beneficial to increase the higher monetary returns. sugarcane + potato inter cropping system recorded higher economic indices viz., Gross returns (Rs. 440450 ha^{-1}), net returns (Rs. 277450 ha^{-1}) and B:C (2.70). Whereas secondly, sugarcane + onion recorded maximum sugarcane equivalent yield (189.53 t ha^{-1}) and monetary benefits like net income and B:C ratio (Rs. 267908 ha^{-1} and 2.59) which are beneficial to increase productivity and profitability of 31.59 and 37.77 % per cent as compared to sole crop. The lowest productivity 5.42 % and profitability of 6.71 % was recorded in sugarcane + chickpea cropping system, but it fixes the maximum atmospheric nitrogen and helps in improving the soil physical properties and organic matter, it creates congenial condition for increasing the soil microbial population.

Conclusion

Among the inter cropping systems, sugarcane + potato intercropping system growing on medium deep soil in pre-seasonal season under irrigated condition was recorded higher sugarcane equivalent yield and maximum economic returns than sugarcane + onion and sugarcane + chickpea.

Keywords: Intercrops, Sugarcane, Sugarcane equivalent yield.

Effect of nutrient management on seed production of tossa Jute (*C. olitorius* L.)**D. P. PACHARNE¹ and D.V. DESHMUKH²***Mahatma Phule Krishi Vidyapeeth, Rahuri-413 722, Maharashtra, India***Introduction**

Jute is one of the most important commercial crops of eastern Indian states of West Bengal, Assam, Bihar, Orissa and eastern Uttar Pradesh, being an important foreign exchange earner and supporting nearly 7 million small and marginal families, industrial employees and trade. Good quality seed of improved variety give the highest return relative to its cost. The balance nutrition to jute seed production takes place not only through chemical fertilizers but organic fertilizers are essential to maintain soil health. The organic fertilizers are climate resilient so which will be added along with chemical fertilizers with appropriate combination are beneficial to increase physical, chemical and microbial properties of soil. Quality seed of jute is directly related to the balance nutrition to jute seed growing areas, So limited work has been done on proper nutrition on seed production of jute which are facing to climate change and its impact.. Therefore, keeping these points in view the present investigation was carried out to find out appropriate fertilizer dose of FYM along with fertilizer levels in seed production of tossa jute (*Corchorus olitorius* L.).

Materials and Methods

The experiment was conducted in farm of Jute and Allied Fibre crops, Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra (situated at lies between 19° 48' N and 19° 57' N latitude and 74° 32' E and 74° 19' E longitude. The altitude varies from 495 to 569 meter above mean sea level) during 2017-2019. The soil of the experimental site is clay loam in texture (Clay- 47.45 %, Silt- 34.21 % and Sand- 17.43 %) with having pH 8.2 and EC 0.29 dS/m and organic carbon 0.56 % in top of 15 cm soil. The soil available nitrogen, phosphorus and potassium were 178.11, 17.02, 423.0 kg/ ha and moderate in Fe, Mn, Zn and Cu were 6.59, 9.51, 0.62 and 3.41 $\mu\text{g g}^{-1}$ of soil. The average annual rainfall at Rahuri is 520 mm. The rainfall received from south-west monsoon from May to November was 641.4, 307.0 and 693.8 mm and rainy days 34, 15 and 43 during 2017, 2018 and 2019, which is beneficial for crop growth and seed development., respectively. The experiment was laid out in Factorial Randomized Block Design during *kharif* season in four replications The Factor-A comprises of organic manure levels i.e. M₁- Control and M₂- FYM @ 5 tons/ha and Factor-B comprises five fertilizer doses (N:P₂O₅:K₂O kg/ ha) i.e F₀-Control , F₁- 60:30:30 kg/ha, F₂- 60:60:60 kg/ha, F₃-80:40:40 kg/ha and F₄- 80:60:60 kg/ha with 10 combinations of FYM and fertilizer doses with tossa jute variety “JRO-524”. The gross plot size was 5.0 x 4.0 m² and net plot sizes were 4.35 x 2.40 m². The crop grown in protective irrigation as per critical growth stages. The plant protection measures were adopted as per recommendations. The crop were harvested at physiological maturity at morning and threshed after sun drying.

Results

The application of organic manures and fertilizer levels to jute crop differed significant effect at harvest. On the basis of pooled mean of three years, application of organic manure levels of FYM@5.0 t/ ha to the jute crop recorded significantly higher growth and yield attributes *viz.* plant height (259.26 cm), number of branches (15.18), basal diameter (1.76 cm), number of pods (62.24) per plant and 1000 seed weight (3.44 g) than control treatment during pooled mean of three years. Similarly, higher growth and yield attributes resulted into significantly higher seed yield of tossa jute were 1.39 t/ha than control (1.24 t ha⁻¹) treatments in Table 1. The application of FYM to jute crop was helpful for higher residual status of organic carbon, available N, P and K in soil as compared to control.

The application of fertilizer levels (N:P₂O₅:K₂O) of 80:60:60 to the tossa jute crop recorded significantly higher growth and yield attributes viz., number of branches (18.67), basal diameter (1.92 cm), number of pods (74.26) per plant and 1000 seed weight (3.44 g) as compared to rest of all treatments but it was at par with the application of fertilizer levels (N:P₂O₅:K₂O) of 80:40:40 kg/ha. Similarly, the higher growth and yield attributes registered to increase the seed yield of jute crop (1.55 t/ ha) on both treatments of fertilizer levels (N:P₂O₅:K₂O) of 80:60:60 and 80:40:40 kg/ha during pooled mean of 3 years, respectively. For economically, the application of organic manures @ FYM 5 ton /ha along with fertilizer level (N:P₂O₅:K₂O) of 80:40:40 kg/ha is beneficial for higher seed yield and higher returns. The interaction effect between application of organic manures and fertilizer levels found to be significant in seed yield of tossa jute and remaining all are non-significant.

Conclusion

On the basis of experiment, it could be concluded that the application of organic manures @ FYM 5 ton /ha along with fertilizer level (N:P₂O₅:K₂O) of 80:40:40 kg/ha is beneficial for higher growth, seed yield and quality of tossa jute (*Corchorus olitorius L.*) in kharif season.under protective irrigation.

Keywords: Growth characters, nutrient management, seed yield and tossa jute.

Ovulation Induction Using Phytoestrogens In Women With Polycystic Ovarian Syndrome

Surovi Saikia, Aparna AK, V. Vijaya Padma*

Translational Research Laboratory, Department of Biotechnology, Bharathiar University, Coimbatore - 641 046, Tamil Nadu, India

Introduction

PCOS (Polycystic ovarian syndrome) is the common endocrinopathy in reproductive age women with a 6.5% prevalence rate. Polycystic ovaries and hyperandrogenism are the cardinal symptoms of PCOS. Due to their potential to act as modulators for estrogen receptor phytoestrogens (PE) interfere with the aromatase enzyme as shown in animal studies. So, PE may be useful as a part for ovulation induction in polycystic ovary syndrome (PCOS).

Methods

1. Generating designer ligands from information stored in crystallized receptor structure
2. Phytoestrogen-ER network construction for PCOS signaling pathway proteins in search of putative targets
3. Rescoring of docking score through the use of Machine Learning Methods
4. QSAR study for activity prediction of phytoestrogens and designer molecules

Results

Based on the binding site conformation and residues involved structure-based drug designing methods were employed for designing molecules or to analyze the affinity of certain class of compounds viz. phytoestrogens to fit the ER receptor site crucial for binding. Construction of PE-ER network will highlight the synergy aspect of phytoestrogen if any such of them is found to be acting simultaneously on more than two proteins due to presence of genomic heterogeneity for PCOS and which are kept for further validation. Ligands that exhibit higher docking score accompanied by low nM activity value were considered for pharmacophore analysis that will help for the common molecular scaffold that can be used further to screen chemical libraries.

Conclusion

Finally, the chemical diversity of the phytoestrogens and ligands will be found through scaffold representations using molecular graphs so as to analyze the distribution of compounds. Regression analysis from the generated equation will give the predicted activity value of each such compound

in nM concentration and the significance aspect of the equation and the co-relation will be further validated through the use of F-statistics.

Keywords: Polycystic ovarian syndrome; phytoestrogens; ovulation; estrogen receptor; Machine Learning Methods

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Asymmetric Impact Of Growth And Energy Consumption On Emissions

Md Imdadul Haque

Department of Economics, Aligarh Muslim University, Aligarh, U.P., India-202001

Purpose

Climate change is aggravated by carbon dioxide (CO₂) emissions. These emissions are a by-product of economic growth which is a matter of grave environmental concern as it leads to global warming. Worldwide CO₂ emissions contribute to more than 60% of the increase in greenhouse gases (Ozturk and Acaravci, 2010) while India ranks third in the world in terms of carbon emissions. (Ahmad et al. 2016). As per Emissions Gap Report 2019, India is one of the top four emitters accounting for around 7% of total global emissions.

Kuznets (1995) postulated an inverted U-shaped relationship between per capita income and income inequality called Environmental Kuznets Curve (EKC). He theorised that at the outset, there is an increase in inequality as income increases, and then after reaching the threshold, inequality decreases. Afterwards, Grossman and Krueger (1991) modified the same logic to represent the relationship between carbon emission and per capita income. Recent studies have reported an N-shaped EKC which postulated that environmental degradation will start to increase again after a particular level of income (Allard et al. 2018).

For India, the studies support the presence of EKC (Mukhopadhyay 2008). But the N-shaped Kuznets curve is rarely visible in literature except for a few studies (Hossain et al., 2023). Also, studies on the asymmetric relationship between emissions, growth and energy are scanty.

This study proceeds with twin objectives:

- a) Test the presence of N-shaped EKC
- b) Test for an asymmetric relationship between economic growth and energy consumption and CO₂ emissions

METHODOLOGY

This study proposes an asymmetric relationship between CO₂ emission GDP and Energy using the following nonlinear ARDL functional form:

$$\begin{aligned} \Delta CO_{2t} = & \beta_0 + \beta_1 CO_{2t-1} + \beta_2 GDP_{t-1}^+ + \beta_3 GDP_{t-1}^- + \beta_4 Energy_{t-1}^+ \\ & + \beta_5 Energy_{t-1}^- + \beta_4 (GDP)^2 + \beta_5 (GDP)^3 + \beta_1 Urbanization \\ & + \sum_{i=1}^v \gamma_{1i} \Delta CO_{2t-i} + \sum_{i=0}^w \gamma_{2i} \Delta GDP_{t-i}^+ \\ & + \sum_{i=0}^x \gamma_{3i} \Delta GDP_{t-i}^- \\ & + \sum_{i=0}^y \gamma_{4i} \Delta Energy_{t-i}^+ \\ & + \sum_{i=0k=1}^z \gamma_{5i} \Delta Energy_{t-i}^- + \sum_{i=0k=1}^z \theta_{6i} \Delta (GDP)^2 + \sum_{i=0k=1}^z \theta_{7i} \Delta (GDP)^3 \\ & + \sum_{i=0k=1}^z \theta_{5i} \Delta Urbanization + \varepsilon_t \end{aligned}$$

$\beta_1, \beta_2, \beta_3, \beta_4$ are the long term positive and negative shocks of GDP and energy on co2 emissions. $\gamma_1, \gamma_2, \gamma_3,$ and γ_4 are the short-run positive and negative impacts of GDP and energy on CO2 emissions. Using non-linear ARDL, GDP per capita and energy use is decomposed into positive and negative shocks or changes.

Result

Table 1: Unit root tests

	CO2	GDP	E	U
Constant	NS	NS	NS	NS
Constant, Linear Trend	NS	NS	NS	S
None	NS	NS	NS	NS
	DCO2	DGDP	DE	DU
Constant	S	S	S	NS
Constant, Linear Trend	S	S	S	NS
None	S	NS	NS	NS

S-Significant; NS-Not significant

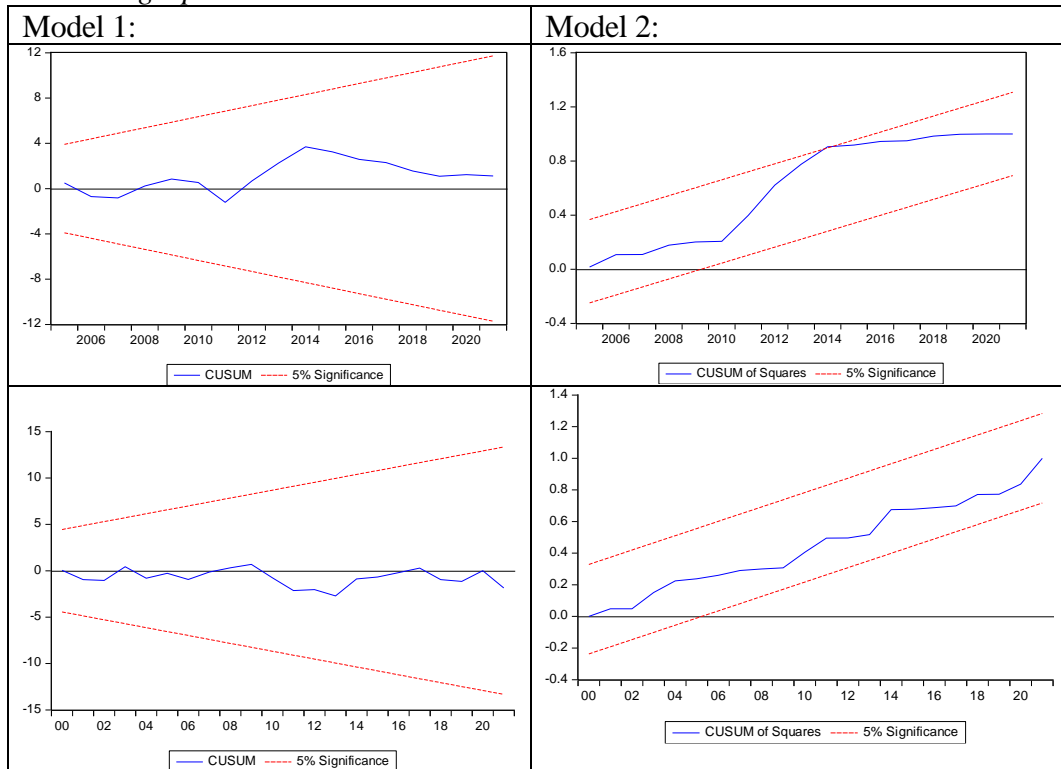
As variables are stationary at level and first order, the ARDL approach developed by Pesaran, Shin, and Smith (2001) is used. As, variables can depict non-linear nature Shin (et al. 2014) extended the ARDL framework to incorporate the non-linear nature of variables.

Table: NARDL results

Restricted Constant and No Trend (Automatic lag selection)				
	Model 1: ARDL(4, 1, 2, 4, 4, 0)		Model 2: ARDL(4, 0, 4, 1, 4, 4, 4)	
Variable	Coefficient	Prob.	Coefficient	Prob.
GDPC	3.75	0.87		
GDPC2	-0.14	0.95	-8.92	0.00

GDPC3	0.00	0.97	9.23	0.00
GDPC_POS			7.84	0.00
GDPC_NEG	-0.33	0.00	2.97	0.01
E				
E_POS			1.45	0.00
E_NEG			-0.41	0.45
U	1.45	0.00	0.13	0.90
C	-4.08	0.00	19.19	0.00
<hr/>				
CointEq(-1)*	-0.55	0.00	-0.78	0.00
Bounds test (F-statistic)	6.80	2.39; 3.38	28.99	2.27;3.28
<hr/>				
Jarque-Bera	0.24	0.89	0.01	1.00
Breusch-Godfrey Serial Correlation LM Test	5.44	0.07	2.41	0.30
Heteroskedasticity Test: Breusch-Pagan-Godfrey	24.2	0.23	26.85	0.47
CUSUM & CUSUMSQ	Within the range		Within the range	

Figure: CUSUM graphs



Conclusion

This study attempts to study the asymmetric relationship between CO₂ emissions, per capita GDP, energy consumption and urbanization. The study reports that when per capita GDP increases, CO₂ emission increases, which has a coefficient of 7.83; when the per capita GDP decreases, the coefficient is 2.98. The coefficient when per capita GDP increases are much higher than when per capita GDP decreases. The variable energy consumption is positive and significant when the positive change in energy consumption is considered. Still, the energy consumption is not significant when considering it a decrease in energy consumption. This implies that a decline in energy consumption is not necessarily leading to lower emissions. The study finds an N-shaped Kuznets curve as the coefficient of the quadratic term of per capita GDP is significant and has a negative sign, and the cubic term of per capita GDP is significant and positive. This result leads to the recommendation that India needs to pursue climatic prudence aggressively.

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Protected cultivation: Enhancing socio-economic conditions of farmers

Manisha*, Bas Kaur, Vinod Kumari and Sahil Boora

Department of Sociology, CCSHAU, Hisar

Purpose

Increasing world population, climate variations, land degradation, reducing the availability of agriculture land, as well as increasing the restriction on availability of natural resources also increasing the demand of quality garden-fresh food products are push to transformed traditional cultivation to modern techniques like protected cultivation. Farmers can significantly raise their income by cultivating crops under protected cultivation of vegetables in off-season as the vegetables produced during their normal season usually do not draw good returns due to large

accessibility of these vegetable in the markets. The system protects production of crops from adverse environmental conditions such as high and low temperatures, frost, hail, heavy rain and snow. Plant growth is enhanced and crops mature faster because of better nutrient supply. Water usage is optimized and water loss will be reduced therefore good water conservation is practiced. Protected Cultivation is a new farming method that allows variations in the climatic conditions and many cropping patterns. India has a big problem of climatic extremes such as floods, droughts and other climatic abnormalities that cause crop losses regularly or damages resulting in economic losses. So, to avoid these all harmful conditions, the protected cultivation method was founded, which provides better opportunities for the Indian farmers. With the progress of liberalized economy and the advent of newer technologies in agriculture, protected cultivation has boosted in the field of agriculture worldwide. India's initial exposure to really advance protected farming of vegetables and alternative high value agriculture manufacture came through the IndoIsrael project on greenhouse cultivation, initiated at the New Delhi-based. Indian Agricultural analysis Institute (IARI) in 1998, shortly when the institution of diplomatic ties thereupon country. However, the Israeli consultants left Asian nation in 2003 at the tip of this five-year project, IARI continued to take care of the ability, career it the Centre for Protected Cultivation Technology (CPCT). It has, within the past ten years, managed to refine and up market the system to scale back prices, besides coming up with greenhouse structure to suit native conditions.

Keywords: Protected cultivation, Socio-economic conditions, Farmers

Conclusion

In future, there is a need to encourage environmentally degradable material for storage and handling of vegetable produce, besides adopting good agricultural practices and IPM. There is also need of developing technology for production of eco-friendly plastic and eco-friendly disposal of waste plastic. Proper trainings must be provided as the farmers have lack of technical knowledge and lack of knowledge about package of practices.

The Anticancer Effects of Novel Pyridoxal Kinase inhibitors against leukemic Cells

Pallabi Banerjee and Imteyaz Qamar*

School of Biotechnology, Gautam Buddha University, Greater Noida, U.P. 201312, India

Purpose

Cancer is a group of diseases that affect different organs in the body and is one of the leading causes of death worldwide. One of the recently identified anti-leukemia target is Pyridoxal kinase PDXK. An enzyme that plays a critical role in the metabolism of vitamin B6, which is essential for various biological processes, including DNA synthesis, immune function, and neurotransmitter synthesis. Several studies have suggested that PDXK may play a tumor-suppressive role in various cancers, and that downregulation of PDXK expression may contribute to tumor growth and progression. Therefore, targeting PDXK with small molecule inhibitors or other therapeutic approaches may represent a promising strategy for cancer treatment.

Methods

We identified potential inhibitors of PDXK through a high-throughput structure-based virtual screening approach. Docking scores were used to evaluate and select the novel lead compounds, which were further tested in vitro on leukemic cell lines. The cytotoxicity assay and western blotting were used to determine the efficacy of these compounds, and the mechanism of apoptosis was assessed using qRT-PCR.

Results

The Molecular docking studies indicated that the top six hits bound at the substrate binding site of the protein where the co-crystallized ligand is bound. In vitro studies suggested that, among the top 6 compounds, compound 3 (C03) inhibited the intrinsic PDXK activity and showed anti-proliferative activity at lower concentration (10 μ M) range in human leukemic cells. In addition, compound C03 triggers intrinsic pathway for apoptosis in human leukemic cells K562 via activation of apoptotic factors.

Conclusions

Taken together these findings provide compelling evidence that compound C03 is a promising PDXK inhibitor that can be utilized as a scaffold lead to design more effective and selective molecules targeting PDXK in order to inhibit cancer progression.

Keywords: Molecular docking, Potent PDXK inhibitors, Cytotoxicity assays, Apoptosis, Cancer therapy

GC-MS analysis, antioxidant and anti-hyperlipidemic efficacy of ethyl acetate and methanolic extract of *Allium humile*

Suhail Anees¹, Showkat Ahmad Ganie¹, Rabia Hamid¹

¹Department of Biochemistry, University of Kashmir, Srinagar, J&K, India

Purpose

Traditional herbal medicines have played an essential role in the treatment of a variety of acute and chronic illnesses without causing any toxicity. Medicinal herbs are frequently used to treat a variety of health issues such as tuberculosis, infections, cancer, diabetes, CVDs, inflammation, hypertension, and so on (Prasathkumar, 2021). Folklore holds that *Allium humile* plays an essential function in reducing cholesterol. The purpose of this study was to look at *Allium humile's* capacity to reduce cholesterol levels in the blood. In this study the rats were given a high fat diet, causing hyperlipidemia, and then treated with the extracts. This study will contribute to the validation of *Allium humile's* role as an antioxidant and anti-hyperlipidemic agent.

Methods

The plant was collected from several sites before being dried and ground. Different solvents were used in the extraction. Soxhlet extraction was used, and the extracts were concentrated and stored at 2 to 4 °C for future use. The extracts were subjected to phytochemical screening and antioxidant assays such as DPPH radical scavenging. The animals were divided in seven groups each having five rats. The group I had normal, group II positive control, group III standard drug, group IV, V had methanolic extract of 50mg/ kg and 100mg/kg, group VI, VII had ethyl acetate extract of 50mg/kg and 100mg/kg. After inducing the hyperlipidemia by giving high fat diet the animals were treated with extracts and their anti-hyperlipidemic activity was checked by evaluating parameters such as cholesterol, LDL, HDL, and triglycerides. The methanolic extract was subjected to GC-MS analysis to determine its composition and compounds.

Results

The phytochemical screening demonstrated that methanolic extract contains the most phytochemicals such as phenols, flavonoids, alkaloids and terpenoids whereas the ethyl acetate extract have phenols, alkaloids, tannins and saponins. The DPPH radical scavenging activity was observed more in methanolic extract than the ethyl acetate extract. At 700 μ g/ml the methanolic extract 71.36% inhibition and ethyl acetate showed 63.9% of inhibition. When compared to ethyl acetate extract, methanolic extracts shown significant effectiveness in lowering cholesterol, LDL, and triglyceride levels. HDL levels in the blood increased more in those who were treated with methanolic extract. All of these findings were compared to the conventional control, atorvastatin.

The GC-MS analysis showed several chemicals, the most notable of which are cyclohexanone, 2-(2-nitro-1-phenylethyl)-, 1-butanol, 3-methyl-, formate, and 1-methyl-5-phenylbicyclo [3.2.0] heptane.

Conclusion

The methanolic extract inhibited DPPH and reduced fat levels significantly. As a result of this study, methanolic extracts have greater antioxidant and anti-hyperlipidemic activity than ethyl acetate extracts, and *Allium humile* is efficient against hyperlipidemia. More research is needed to fully grasp the mechanistic understanding.

Keywords: Hyperlipidemia; Antioxidant; Phytochemicals; GC-MS; DPPH

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Phenotypic And Molecular Characterization of Nellore Brown Sheep – A Popular Mutton Sheep of Rayalaseema Region of Andhra Pradesh

P. Panduranga Reddy*, K. Shakuntala Devi, N. Vinod Kumar, Muralidhar Metta, Alok Bharathi

Department of Animal Genetics And Breeding, College of Veterinary Science, Proddatur-516360, Andhra Pradesh

Purpose:

The Nellore sheep has three variants *viz.* Brown, Jodipi and Palla. The breed description given by the NBAGR pertains to Jodipi variant of Nellore sheep. The present study was aimed to characterize the Nellore brown sheep both at phenotypic and molecular level. The Nellore brown sheep is distributed in Kadapa, Kurnool, Anantapur and part of Prakasam districts of Andhra Pradesh and Mahaboobnagar and Nalgonda districts of Telangana State. Because of superior production performance of the breed and adaptability to local climatic conditions, the Nellore Brown sheep attained considerable importance among sheep herders.

Methods:

A stratified random sample survey was conducted in Andhra Pradesh and Telangana states populated with huge number of Nellore sheep. The data was measured on 1142 sheep from 22 villages of ten mandals in six districts of two states. A total 50 blood samples from unrelated animals from Nellore brown sheep were collected to characterize the genetic group at the molecular level. Genomic DNA was isolated using standard high salt method. The multiplex PCR products of FAO recommended 27 microsatellite loci were used for genotyping on an automated DNA sequencer.

Results:

The predominant color pattern in Nellore brown sheep was brown. Rams are horned and ewes are polled. Males recorded significantly higher biometric measurements than females. District has significant influence on the biometric measurements with higher recordings in Kadapa district and this area would be considered as native tract for this sheep. The reproductive performance of Nellore brown sheep was ideal and within the range of species.

The molecular data reveals that a total of 253 alleles were found in Nellore sheep across the 27 microsatellite loci. On an average about 9.7 alleles per locus were observed the genetic group. The mean observed heterozygosity value was 0.593 ± 0.043 in Nellore Brown. The PIC of different markers ranged between 0.698 (BM8125) and 0.922 (DYMS1) for. Bottleneck analysis revealed

that absence of recent bottleneck in the population. A comparison at molecular level with another local available genetic group named Macherla, the F_{ST} between the two genetic groups is 0.059 and the Nei's unbiased genetic distance is 0.212.

Conclusion: Nellore brown sheep had substantial genetic variation as indicated by a greater number of breed alleles and high polymorphic information content (PIC) values. The Nellore brown sheep was found to be genetically distinct from Macherla sheep as evident by F_{ST} Values and Nei's standard genetic distance estimate.

Keywords: Nellore brown sheep, Kadapa, body weights, allele

Management Of Tomato Fruit Borer, *Helicoverpa Armigera* Through Bio Intensive Pest Management Module In Tomato Ecosystem

M.K. Mahla, Hemant Swami, Anil K Vyas

Department of Entomology, RCA, MPUAT, Udaipur, 313001

Introduction

Tomato is a highly perishable fruit crop attacked by a number of insect pests. The tomato fruit borer *Helicoverpa armigera* is the major insect pest among the pests infesting tomato. It attacks fruits and makes it unfit for human consumption causing considerable crop loss upto 55 per cent in yield. Indiscriminate and injudicious use of chemical pesticides leads to the outbreak of secondary pests, development of insecticide resistance including resurgence which ultimately affects the plant and soil ecosystem. The increasing concern for environmental pollution has evoked a worldwide interest in the Bio intensive pest management, which can protect the crop in a ecofriendly manner.

Vegetables are the most essential component of the Indian diet and India is the world's second

Method

The experiment were conducted at Farmer's field, at Madar and Brahamno ki Hundar (Badgaon) over an area of 2.0 ha for each treatment during 2020-21 and 2021-22 for two consecutive crop seasons to evaluate the efficacy of the BIPM module against tomato fruit borer. The BIPM module comprised of Seed treatment with *Trichoderma harzianum* @ 10g/kg of seeds, spray of Azadirachtin 1500 ppm @ 2 ml/lit, *Beauveria bassiana* @ 1×10^8 conidia /gm, @ 5g/lit, Spray of HaNPV (1.5×10^{12} POBS/ha), *Bacillus thuringiensis* @ 1kg/ha-1, against *Helicoverpa armigera*. . The module was evaluated in comparison with chemical control (spray of Spinosad 45 SC @ 0.25 ml/l) and untreated check in the farmers' field. Observations were recorded on larvae/ plants, fruit damage (%) and fruit yield (t/ha).

Result

The experiment were conducted in *Rabi*, 2020-21 and 2021-22 at farmers field to record the incidence of *Helicoverpa armigera*. The results reveal that no significant difference was observed between BIPM package and chemical control with regard to the parameters *viz.*, number of *H. armigera* larvae/plant and fruit damage. BIPM package was equally effective as chemical control against *H. armigera*. Chemical control module recorded the highest yield (14.77 t/ha) which was at par with the yield recorded in BIPM package (13.59 t/ha). Significantly, low fruit yield was recorded in untreated control (8.73 t/ha).

Conclusion

It could be concluded that BIPM package had promising results in minimizing the pest damage with higher yield. Use of BIPM packages by the farmer will result in less use of pesticide which will be safer for the environment and human health.

Keywords: Tomato, BIPM, *Helicoverpa armigera*, Bio- pesticides

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Extent And Pattern Of Occurrence Of Lac Host And Lac Insect Resources In Arid Western Plains Of India**Hemant Swami*, Sheenam Bhateja and M.K. Mahla***Department of Entomology, RCA, MPUAT, Udaipur, 313001***Introduction**

The Lac insect, *Kerria lacca* (Kerr) is a unique insect of economic importance producing the natural resin of wide use. It secretes resin in the form of lac to protect its body and is found throughout the world in different agro-climatic conditions on wide range of host plant. India is the global leader in lac production and contributes about 85 percent of world lac production. Lac occurs in most parts of India but mainly cultivated in Jharkhand, Chhattisgarh, Madhya Pradesh, Maharashtra, Odisha, West Bengal, Rajasthan, Gujarat and parts of some other states (Yogi *et al.*, 2018). The major host plants of *K. lacca* include bargad, palas, kusum, ber, peepal, red gram and *Flemingia semialata* (Monobrullah *et al.*, 2016). However, natural lac insect in various parts of Arid Western Plains occurrence is reported throughout the state with number of specific host plants. Presence of lac insect on different host plants are sign of favourable climatic condition for the natural occurrence of lac insect/ host plants. There is lack of awareness among local people about the existence of lac insect genetic resources on these host trees and ignorantly, the natural habitat of lac insects of the region is destroyed. Host plants/ lac insects recorded from this region will help to promote lac culture in other areas as well as biodiversity of lac insect species will remain conserved and maintained. The present field study was carried out with the intent to record the lac insect occurrence and also to record the new or potential host plants during 2021-22 under NPCLIGR.

METHOD

In the present study block wise survey were conducted in total 30 districts of Arid Western Plains of three states of Rajasthan, Haryana and Gujarat of the country. The field surveys were conducted in 84 blocks of 30 districts of these three states during June-July, 2022 to document occurrence of lac insect under the ICAR funded "Network Project on Conservation of Lac Insect Genetic Resources". All districts were surveyed to identify natural occurrence sites, with documentation of block wise occurrence, colour variation and lac encrustation on host plants. Information was also taken from traders and farmers at block level. The lac insect populations were located through visual observations and through binoculars, especially on reported lac host species. If lac insects were noticed, then the branches having the lac insect were collected by using secateurs and tree pruner, kept in the 60-mesh net and labelling.

Result

The findings of the survey reveals that the presence of lac was recorded prevail in the region among the 21 different host plants *viz.*: *Acacia auriculiformis*, *A. lebbeck*, *A. reticulata*, *A. senegal*, *Butea*

monosperma, *Calliandra calothyrsus*, *Dalbergia sissoo*, *Delonix regia*, *Ficus religiosa*, *F. benghalensis*, *F. palmata*, *F. racemosa*, *F. benamina*, *F. tsiela*, *Peltophorum ferrugineum*, *Pithecellobium dulce*, *Polyalthia longifolia*, *Prosopis cineraria*, *P. juliflora*, *Samanea saman*, and *Ziziphus mauritiana* in the vicinity of the human beings. Total 84 Blocks of 30 districts of these three states were surveyed, in which 29 blocks of 7 districts of Rajasthan, 29 blocks of 11 districts of Haryana and 26 blocks of 12 districts of Gujarat were surveyed, respectively. During survey prevalence of lac insect was noticed 142 locations of which a total of 09 host were identified as natural host for natural prevalence of the lac insect in the region during 2022. It was noticed that at majority of locations lac insect was recorded on Peepal, Ber, Babool, Bargad, Palas, Custard apple, Sheesam, Siras and Keekar out of 142 locations covered with 74 live and 68 dead samples.

Conclusion

Based on the findings, it has been realized that the natural occurrence of Lac was recorded on era of host plants in the vast area of Rajasthan, Haryana and Gujarat region are bestowed with ample population of lac insect and its host plants viz., Peepal, Ber, Bargad and Palas. There is an alarming need to conserve and augment the biological diversity of lac insect of the country through mass awareness programmes among the common people.

Keywords: Survey, Host Plants, Lac Insect, Arid Western Plains

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Growth and development of *Spodoptera frugiperda* (J.E. Smith) on maize at different temperatures

N.D. Zatale* and V.K. Bhamare

Post Graduate Institute of Akola Dr. P.D.K.V. Akola

Purpose:

S. frugiperda has emerged as a great menace to mankind due to its short development period, wide host range, high prolificacy, high dispersal ability and absence of diapause. In many parts of the world, *S. frugiperda* arrives seasonally, but in the event of alternate host availability and congenial weather, it can continue its generations throughout the year endemically and spread to adjacent areas *S. frugiperda* is capable of causing a 100 per cent yield loss due to its unforeseen occurrence from the seedling to the cob formation stage in maize. Fecundity and fertility of *S. frugiperda* is high but the reproductive parameters are generally affected by temperature thus keeping in mind the current scenario of climate change, investigation was conducted to study the growth and development of *Spodoptera frugiperda* (J.E. Smith) on maize at different temperatures.

Method:

The investigations on growth and development of *S. frugiperda* were carried out on maize (*Zea mays* L.) variety Gold 1166 at four different temperature levels viz., 20 °C, 25 °C, 30 °C and 35 °C in a completely randomized design with five replications (20 larvae per replication) under laboratory conditions in BOD incubator. One hundred freshly laid eggs in a group of 20 per replication were kept in petri dish for recording observations in respect of incubation period and per cent egg hatching at different temperature levels. The newly hatched larvae were reared

individually on leaves and slices of stem of maize at different temperature levels viz., 20 °C, 25 °C, 30 °C and 35 °C in round plastic vials (measuring diameter 3.5 cm and height 4 cm). While rearing due care was taken to transfer the larvae into clean plastic vial. Fresh food was provided daily and old food was removed. All the observations necessary to check the effect of different temperatures on growth and development of *Spodoptera frugiperda* were recorded.

Result:

The incubation period of *S. frugiperda* varied significantly when reared on maize at different temperature levels viz., 20, 25, 30, and 35 °C. The mean incubation period of *S. frugiperda* was found to be minimum at 35 °C (1.69 days) followed by 30 °C (2.16 days), 25 °C (3.11 days) and maximum at 20 °C (6.78 days). The significantly highest egg hatchability of *S. frugiperda* was observed to be 94 per cent at 25 °C followed by 30 °C (89 per cent), 20 °C (82 per cent) and lowest at 35 °C (78 per cent). The larval development of *S. frugiperda* was completed by passing through six instars when reared on maize at different temperature levels. The significantly shortest larval duration of *S. frugiperda* was noticed on maize at 35 °C (9.56 days) followed by 30 °C (11.84 days), 25 °C (15.26 days) and highest at 20 °C (31.08 days). The mean larval instar duration of *S. frugiperda* was significantly minimum on maize at 35 °C (1.65 days) followed by 30 °C (1.92 days), 25 °C (2.47 days) and maximum at 20 °C (5.19 days). The significantly highest pupation of *S. frugiperda* was registered on maize at 30 °C (92 per cent) followed by 25 °C (88 per cent), 35 °C (37 per cent) and lowest at 20 °C (34 per cent). The significantly lowest pupal duration to the extent of 6.88 days was recorded on maize at 35 °C followed by 30 °C (8.36 days), 25 °C (11.42 days) and highest at 20 °C (22.14 days). The significantly highest growth index of *S. frugiperda* was observed on maize at 30 °C (7.77) followed by 25 °C (5.76), 35 °C (3.87) and lowest at 20 °C (1.09). The significantly minimum total developmental period (egg to adult emergence) of *S. frugiperda* was noticed on maize at 35 °C (18.13 days) followed by 30 °C (22.36 days), 25 °C (29.79 days) and maximum at 20 °C (60.00 days). The significantly maximum adult emergence of *S. frugiperda* was recorded when larvae were reared on maize at 30 °C (98.2 per cent) followed by 25 °C (96.40 per cent), 20 °C (86.00 per cent) and minimum at 35 °C (68.40 per cent). The significantly longest adult longevity of male *S. frugiperda* was noticed on maize at 20 °C (12.24 days) followed by 25 °C (10.09 days), 30 °C (7.19) and shortest at 35 °C (5.12 days). Similarly, the significantly maximum adult longevity of female *S. frugiperda* was observed on maize at 20 °C (13.84 days) followed by 25 °C (11.16 days), 30 °C (8.51) and minimum at 35 °C (6.32 days). The significantly shortest total life cycle duration of male *S. frugiperda* was registered on maize at 35 °C (23.25 days) followed by 30 °C (29.55 days), 25 °C (39.88 days) and longest at 20 °C (72.23 days). Similarly, the significantly minimum total life cycle duration of female *S. frugiperda* was observed on maize at 35 °C (24.45 days) followed by 30 °C (30.87 days), 25 °C (40.95 days) and maximum at 20 °C (73.84 days). The significantly shortest pre-oviposition period of *S. frugiperda* to the tune of 2.10 days was recorded on maize at 35 °C followed by 25 °C (3.46 days), 30 °C (3.50 days) and longest at 20 °C (4.60 days). The significantly maximum oviposition period of *S. frugiperda* was observed on maize at 20 °C (6.78 days) followed by 25 °C (5.56 days), 30 °C (3.62 days) and minimum at 35 °C (3.10 days). The significantly highest post-oviposition period of *S. frugiperda* was recorded on maize at 20 °C (2.46 days) followed by 25 °C (2.14 days), 30 °C (1.39 days) and lowest at 35 °C (1.12 days). The female of *S. frugiperda* laid numerically maximum eggs (764.40 per female) when larvae fed on maize at 30 °C followed by 25 °C (696.20 per female), 20 °C (451.60 per female), while its egg laying was numerically minimum at 35 °C (195.20 per female).

Conclusion:

Investigation showed that temperature had significant influence on growth and development of *S. frugiperda*. Results showed high temperature-dependent development and the pest can persist effectively in geographical areas having annual temperature within the range of 20 °C to 35 °C. The results conclude that total life cycle along with the duration of various growth stages decreases with an increase in temperature. Study confirms that Indian climatic conditions are best suited for the growth and development of *S. frugiperda*.

Keywords: *Spodoptera frugiperda* (J.E. Smith), temperatures, growth and development.

Morphometrics of *Spodoptera frugiperda* (J.E. Smith) on maize at different temperatures

N.D. Zatale* and V.K. Bhamare

Post Graduate Institute of Akola Dr. P.D.K.V. Akola

Purpose:

S. frugiperda has emerged as a great menace to mankind due to its short development period, wide host range, high prolificacy, high dispersal ability and absence of diapause. In many parts of the world, *S. frugiperda* arrives seasonally, but in the event of alternate host availability and congenial weather, it can continue its generations throughout the year endemically and spread to adjacent areas. *S. frugiperda* is capable of causing a 100 per cent yield loss due to its unforeseen occurrence from the seedling to the cob formation stage in maize. Fecundity and fertility of *S. frugiperda* is high but the reproductive parameters are generally affected by temperature thus considering the above points in view, investigation was conducted to study the morphometrics of *Spodoptera frugiperda* (J.E. Smith) on maize at different temperatures.

Method:

Immediately after hatching ten larvae of each instar of *S. frugiperda* were transferred to separate plastic vials (measuring diameter 3.5 cm and height 4 cm). The larvae were reared individually on maize at 20 °C, 25 °C, 30 °C and 35 °C respectively, in B.O.D incubator. Every day fresh food was provided to the larvae. The observation on the casting of exuviae and head capsule was made under microscope. During each instar, immediately after each moulting, the head capsule width, head capsule length, body length, body width and body weight of each larva was measured with the help of ocular and stage micrometer to the nearest value of 0.1053 mm. The experiment was replicated five times. The application of Dyar's rule (1890) was tested for the number of larval instar when reared at different temperature levels. The observations on morphometrics of pupa were also recorded by measuring pupal width, pupal length and pupal weight of ten pupae replicated five times reared on maize at four different temperature levels viz., 20 °C, 25 °C, 30 °C and 35 °C.

Result:

The mean measurement of larval head capsule width, larval head capsule length, larval body length, larval body width and larval weight of *S. frugiperda* on maize at 20 °C were 0.15 ± 0.006, 0.25 ± 0.002, 0.52 ± 0.064, 0.84 ± 0.029, 1.20 ± 0.03 and 2.10 ± 0.02 mm, 0.16 ± 0.006, 0.28 ± 0.008, 0.51 ± 0.042, 0.85 ± 0.03, 1.28 ± 0.02 and 2.1 ± 0.01 mm, 0.88 ± 0.06, 2.98 ± 0.35, 6.68 ± 0.26, 12.33 ± 0.40, 20.28 ± 0.79 and 27.64 ± 0.60 mm, 0.22 ± 0.008, 0.45 ± 0.003, 1.10 ± 0.38, 2.18 ± 0.065, 3.25 ± 0.07 and 3.94 ± 0.083 mm and 0.35 ± 0.06, 5.20 ± 0.17, 29.50 ± 1.48, 63.30 ± 2.11, 120.8 ± 17.41 and 324.3 ± 19.89 mg for I, II, III, IV, V and VI larval instars, respectively. The corresponding values at 25 °C, 30 °C and 35 °C were 0.20 ± 0.008, 0.32 ± 0.009, 0.71 ± 0.032, 1.08 ± 0.039, 1.28 ± 0.02 and 3.10 ± 0.01 mm, 0.22 ± 0.003, 0.32 ± 0.009, 0.77 ± 0.03, 0.94 ± 0.03, 1.41 ± 0.04 and 3.33 ± 0.01 mm, 1.10 ± 0.09, 4.98 ± 0.54, 7.59 ± 0.35, 14.60 ± 0.50, 18.1 ±

0.38 and 34.7 ± 0.83 mm, 0.16 ± 0.003 , 0.91 ± 0.005 , 1.64 ± 0.072 , 2.66 ± 0.039 , 3.12 ± 0.078 and 3.96 ± 0.082 mm and 1.50 ± 0.02 , 18.40 ± 0.22 , 85.60 ± 1.90 , 214.2 ± 3.01 , 322.2 ± 19.88 and 449.2 ± 17.18 mg for I, II, III, IV, V and VI larval instars, respectively. The corresponding values 30 °C were 0.21 ± 0.007 , 0.33 ± 0.006 , 0.87 ± 0.048 , 1.39 ± 0.044 , 2.1 ± 0.03 and 2.76 ± 0.02 mm, 0.23 ± 0.007 , 0.35 ± 0.005 , 0.93 ± 0.006 , 1.48 ± 0.03 , 2.31 ± 0.01 and 3.11 ± 0.01 mm, 1.62 ± 0.03 , 3.86 ± 0.29 , 8.83 ± 0.76 , 15.40 ± 0.88 , 24.61 ± 0.39 and 35.80 ± 0.65 mm, 0.16 ± 0.005 , 0.47 ± 0.001 , 1.18 ± 0.094 , 2.66 ± 0.034 , 3.41 ± 0.079 and 4.06 ± 0.056 mm, 1.10 ± 0.01 , 11.70 ± 0.80 , 79.60 ± 1.21 , 193.8 ± 10.16 , 349.9 ± 19.19 and 476.6 ± 6.71 mg for I, II, III, IV, V and VI larval instars, respectively. The corresponding values 35 °C were 0.18 ± 0.003 , 0.25 ± 0.006 , 0.41 ± 0.009 , 1.12 ± 0.037 , 2.10 ± 0.02 and 2.80 ± 0.01 mm, 0.19 ± 0.006 , 0.25 ± 0.008 , 0.39 ± 0.004 , 0.91 ± 0.002 , 2.20 ± 0.03 and 2.90 ± 0.01 mm, 0.94 ± 0.06 , 3.06 ± 0.56 , 10.40 ± 0.87 , 15.90 ± 0.38 , 23.83 ± 0.69 and 29.80 ± 0.81 mm, 0.20 ± 0.004 , 0.61 ± 0.061 , 1.02 ± 0.038 , 2.11 ± 0.035 , 2.95 ± 0.008 and 3.68 ± 0.067 mm and 0.62 ± 0.07 , 10.81 ± 0.90 , 73.26 ± 1.72 , 112.2 ± 8.68 , 186.7 ± 12.19 and 339.6 ± 17.64 mg for I, II, III, IV, V and VI larval instars, respectively. The observed progression factors for larval head capsule width, larval head capsule length, larval body length, larval body width and larval weight of *S. frugiperda* at 20 °C were 1.42, 1.40, 1.75, 1.53 and 4.45, respectively. The corresponding values at 25 °C, 30 °C and 35 °C were 1.49, 1.48, 1.86, 1.93 and 3.72; 1.44, 1.45, 1.58, 1.70 and 3.84 and; 1.49, 1.49, 1.82, 1.57 and 4.87, respectively. The significantly maximum pupal width of *S. frugiperda* was registered on maize at 25 °C (3.80 mm) followed by 30 °C (3.50 mm), 20 °C (3.20 mm) and minimum at 35 °C (3.05 mm). The pupal length of *S. frugiperda* was significantly maximum on maize at 25 °C (15.40 mm) followed by 30 °C (14.80 mm), 35 °C (13.60 mm) and lowest at 20 °C (12.70 mm). The significantly highest pupal weight of *S. frugiperda* was noticed on maize at 25 °C (204.80 mg) followed by 30 °C (171.20 mg), 20 °C (135.60 mg) and lowest at 35 °C (118.20 mg).

Conclusion:

Investigation showed that temperature had significant influence on morphometrics of *S. frugiperda*. The increase in head capsule width and length from the first to sixth instars showed regular geometric progression in successive larval stages and thus proved Dyar's rule.

Keywords: Morphometrics, length, width, weight and temperatures.

**Life-history traits of *Spodoptera frugiperda* (J.E. Smith) on maize at different temperatures
N.D. Zatale* and V.K. Bhamare**

Post Graduate Institute of Akola Dr. P.D.K.V. Akola

Purpose:

S. frugiperda has emerged as a great menace to mankind due to its short development period, wide host range, high prolificacy, high dispersal ability and absence of diapause. In many parts of the world, *S. frugiperda* arrives seasonally, but in the event of alternate host availability and congenial weather, it can continue its generations throughout the year endemically and spread to adjacent areas *S. frugiperda* is capable of causing a 100 per cent yield loss due to its unforeseen occurrence from the seedling to the cob formation stage in maize. Fecundity and fertility of *S. frugiperda* is high but the reproductive parameters are generally affected by temperature thus keeping in mind the current scenario of climate change, investigation was conducted to study the life-history traits of *Spodoptera frugiperda* (J.E. Smith) on maize at different temperatures.

Method:

The life-fecundity tables of *S. frugiperda* on maize at different temperature levels viz., 20 °C, 25°C, 30 °C and 35 °C were constructed by studying 100 eggs in a group of 20 per replication. The eggs

were glued on white tissue paper and kept in petri plate in order to facilitate observations on egg hatching. All the larvae soon after hatching were reared individually on fresh leaves, tender stem and whorls of host plants at the temperature range of 20 °C, 25°C, 30 °C and 35 °C in BOD incubator. Fresh food was provided daily. The observations were made daily on hatching, larval and pupal development, successful adult emergence, fecundity and age-specific mortality in eggs, larvae, pupae and adults were recorded to estimate the life-history traits of *S. frugiperda*.

Result:

S. frugiperda when reared on maize at different temperature levels viz., 20 °C, 25 °C, 30 °C and 35 °C the survival of immature stages (l_x) was observed to the extent of 0.24, 0.78, 0.79 and 0.20 per individual within a pivotal age of 62, 31, 24 and 21 days, respectively, the net reproductive rate (R_0) to the tune of 43.94, 258.00, 282.74 and 15.65 females per female per generation, respectively, the mean length of generation time (T) to the extent of 65.22, 38.29, 30.02 and 24.34 days, respectively, innate capacity for increase in numbers (r_m) to the tune of 0.058, 0.145, 0.188 and 0.113 female per female per day, respectively and finite rate of increase in numbers (λ) to the extent of 1.06, 1.16, 1.21 and 1.12 females per female, respectively. Doubling period was observed to the extent of 11.95, 4.78, 3.69 and 6.13 days, respectively. On reaching to the stable age-distribution the population of *S. frugiperda* reared on maize at 20 °C in egg, larval, pupal and adult stages contributed to the extent of 70.23, 29.45, 0.31 and 0.01 per cent, respectively. The corresponding figures for 25 °C, 30 °C, 35 °C were 40.07, 51.92, 6.60 and 1.41 per cent; 33.48, 53.90, 9.58 and 3.04 per cent and; 48.29, 45.43, 5.27 and 1.01 per cent, respectively. The highest sex ratio (Male: female) was registered on maize at 20 °C (1:1.18) followed by 25 °C (1:1.05), 30 °C (1:1.02) and lowest at 35 °C (1:0.66). On reaching to the stable age-distribution the population of *S. frugiperda* reared on maize at 20 °C in egg, larval, pupal and adult stages contributed to the extent of 70.23, 29.45, 0.31 and 0.01 per cent, respectively. The corresponding figures for 25 °C, 30 °C, 35 °C were 40.07, 51.92, 6.60 and 1.41 per cent; 33.48, 53.90, 9.58 and 3.04 per cent and; 48.29, 45.43, 5.27 and 1.01 per cent, respectively.

Conclusion:

Investigation showed that temperature had significant influence on life-history traits of *S. frugiperda*. Studies observed high mortality in early larval instars which ensures that the pest can be easily tackled during early instars. Pest showed high net reproductive rate, innate capacity for increase in numbers, finite rate of increase in numbers and less generation time and doubling period at temperature range of 25°C to 30°C which confirms that it can be most dreadful at this temperature range. Indian climate is best suited for *S. frugiperda*.

Keywords: Life-history traits, *S. frugiperda*, temperatures, survival and fecundity.

Influence of weather parameters on incidence of cotton leaf curl disease during the decade of 2011-20

N.K. Yadav*, Narender Singh, Harbinder Singh, Narender Kumar and Prashant Chauhan
CCS Haryana Agricultural University, Hisar Haryana-125004 India

Purpose

Cotton cultivation is as ancient as human civilization and known as king of fibers due to its key role in current Indian agriculture. India ranks first with production (37.1 million bales) but having very poor productivity (487 kg/ha) due to various biotic and abiotic factors. Among all the factors which leads to poor productivity, cotton leaf curl disease (CLCuD) which is caused by cotton leaf curl virus (CLCuV) and transmitted by whitefly (*Bemisia tabaci*) become one of the major factors in recent years. This disease was firstly time reported from Nigeria in 1912 with its characteristic

symptoms of downward curling of leaves in *G. hirsutum*. Later in 1960s, it was noticed in Pakistan and remained a minor disease for 20 years. However, this minor disease starts to become major and signaled epidemic around 1988 with release of highly susceptible Pakistan cotton variety, S12. From Pakistan it rapidly spread to other areas north western India. Major contributing factors for development of CLCUV epidemics are large area under cultivation of susceptible varieties, presence of alternate hosts, survival of viral inoculum, prevailing environmental conditions and activity of viruliferous whiteflies. As compared to other contributing factors, environmental conditions play most significant role. Keeping in view the economic importance of this disease, present investigation was carried out over a period of decade to evaluate the relationship between environmental factors and whitefly population for the development of cotton leaf curl viral disease.

Methods:

The investigation was carried out from the year 2011 to 2020 with the objective to find out the influence of weather parameters on the development of cotton leaf curl disease at CCS HAU, Cotton Research Station, Sirsa on susceptible cotton cultivar HS 6. The observations on disease progress and whitefly population were recorded on standard meteorological week basis at an interval of 7 days from the initiation of disease symptoms. Per cent disease intensity (PDI) was recorded as per scale proposed by AICCIP (2016).

Results:

Correlation analysis of CLCuD percent disease intensity (PDI) with weather parameters:

Correlation studies between various weather parameters and CLCuD percent disease intensity (PDI) on cotton during 2011-2020 exhibited significant effect of weather variables on the CLCuD (PDI). Maximum temperature exhibited highly negative correlation with CLCuD (PDI) and values of correlation coefficient (r) ranging from -0.461 (in year 2020) to -0.872 (in year 2016). The correlation of minimum temperature was significant only for year 2013 (r= -0.520), 2014 (r= -0.614), 2015 (r= -0.504) and 2019 (r= -0.433). Morning Relative Humidity (RH). and evening RH. both exerted a highly significantly correlation over the years with r-values ranging from 0.258-0.811 and 0.106-0.817, respectively. Bright sunshine hours showed positive correlation with CLCuD (PDI) for year 2013 (0.157), 2014 (0.384) and 2015 (0.532). Rainfall did not influence the CLCuD (PDI) significantly.

Correlation analysis of whitefly population with weather parameters:

The coefficients of correlation of various weather parameters with white fly population on cotton during 2015-2020 revealed that maximum temperature negatively influence the white fly population with r-values ranging from -0.367 (2016) to -0.597 (2017). Positive correlation of white fly population with minimum temperature was found only during 2015 (r= 0.287), 2016 (r= 0.263), 2017 (r= 0.062) and 2018 (r= 0.435) whereas during the years 2019 (-0.399) and 2020 (-0.022) it was negatively correlated. Morning and evening relative humidity both favored whitefly population as showing highly significant and positive correlation over all the years. Coefficients of correlation (r) of whitefly population with rainfall were recorded to be 0.234 (2015), -0.094 (2016), 0.023 (2017), 0.108 (2018), 0.155 (2019) and -0.034 (2020).

Interplay of CLCuD and white fly

The correlation between the CLCuD incidence and CLCuD PDI was found to be highly positive with r-values between 0.932 (2016) and 0.998 (2020). It shows that with increase in diseases incidence disease severity also increases. CLCuD incidence (%) was also found to be positively correlated with the whitefly population as reflected by high values of correlation coefficient (r) ranging from 0.276 (2015) to 0.841 (2020). The correlation between PDI of CLCuD and whitefly population was also highly positive and significant for most of the years during the period of study.

For the years 2017, 2019 and 2020 r-values ranged from 0.689 to 0.821 showing high degree of positive correlation.

Regression analysis of weather parameters with CLCuD (PDI):

Step-wise regression models of various weather parameters' effect on per cent disease intensity (PDI) of CLCuD on cotton during 2011-2020 revealed that the weather parameters accounted for high variability in CLCuD (PDI) over the years. The coefficient of determination (adjusted R^2) ranged from 0.17 to 0.79 exhibiting 17 to 79 per cent variability in the disease incidence. Among all the considered weather variables, maximum temperature and evening relative humidity exert positive effects on the disease incidence.

Regression analysis of weather parameters with whitefly population:

Step-wise regression models of various weather parameters' effect on per cent disease incidence of CLCuD on cotton was calculated during 2011-2020. Among the various weather parameters, RH was major driver behind the whitefly population build-up. The coefficient of determination (R^2) ranged from 0.25 to 0.62 from the years 2015-2020 explaining 25 to 62 per cent variability in the whitefly population.

Conclusions:

The CLCuD development was highly correlated with the whitefly population. Whereas, disease development was controlled by relative humidity (positively) and temperature (negatively).

Keywords: Cotton, cotton leaf curl disease, *Bemisia tabaci*, weather parameters, *Gossypium hirsutum*

Bio-Efficacy of Bio-Rational Insecticides Against Pod Borer, *Helicoverpa Armigera* of Pigeon Pea**Anil Vyas, Dr. M.K Mahla, Hemant Swami, Deependra saini and Ajay Yadav****Introduction**

Pigeon pea [*Cajanus cajan* (L.) Millsp.] is an important pulse crop predominantly cultivated in tropical and subtropical regions of the world. The crop is extremely vulnerable to attack by a variety of insect pests, both in the field (at different phases of crop growth) and storage. The major insect pests of pigeon peas include the pod borer (*Helicoverpa armigera*), plume moth (*Exelastis atomosa*), spotted pod borer (*Maruca testulalis*), field bean pod borer (*Adisura atkinsoni*), tur pod fly (*Melanagromyza obtusa*), aphid (*Aphis craccivora*), white fly (*Bemisia tabaci*). The major pest among them is, *H. armigera*, results in a significant yield loss of 25,000 tones of grains per year, or more than 3750 million rupees annually. The primary line of defense and key element of an integrated pest management plan continues to be insecticides. Indiscriminate and injudicious use of conventional pesticides leads pest resistance, secondary pest outbreak and decline in natural enemies in agro-ecosystems.

Method

The experiment was conducted in kharif 2021-22 and 2022-23 at agronomy farm, RCA, Udaipur for two consecutive crop seasons to evaluate the bioefficacy of biorational insecticides against Pod borer. The treatments includes Neem seed kernel extract (NSKE) @5%, Karanj oil @2%, *Bacillus thuringiensis* @3.0g/l, *Beauveria bassiana* @5.0g/l, Chlorantraniliprole 18.50%SC @0.3ml/l, Flubendiamide 39.35%SC @0.2 ml/l, Clothianidin 50% WG @0.3 g/l and untreated control. Observations were recorded on larvae / plants and Pod damage (%).

Result

The results revealed that flubendiamide 39.35% SC proved to be most effective and registered minimum infestation of (1.74%) followed by Chlorantraniliprole 18.50% SC (1.91%), however, all these treatments were observed at par with each other. The ascending order of effectiveness of these treatments was: Flubendiamide 39.35% SC > Chlorantraniliprole 18.50% SC > B.t > Clothianidin 50% WG > NSKE > *Beauveria bassiana* > Karanj oil.

CONCLUSION

It could be concluded that biorational insecticides had promising result in minimizing the pest damage and the problems of pest resistance, secondary pest outbreak.

Keywords: Biorational, *Helicoverpa armigera*, Pigeon pea, Bioefficacy

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Identification Of *Colletotrichum* Species Associated with Anthracnose Disease of Chilli In Major Chilli Growing Area Of India

Abhishek V. Bhirangi ^{1,2*}, Dr. Manju Vishwakarma ¹

¹ Department of Plant Pathology, Research and Development Centre, Ankur Seeds Pvt. Ltd., Nagpur, 440018.

² Ph. D. Student, Department of Biotechnology, Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur 440001.

Purpose

Anthracnose (*Colletotrichum spp.*) disease of *capsicum annum* is the most widespread disease of world in particular India causing upto 80% yield loss to hot pepper cultivars. Anthracnose is known to cause by one of the four species of *Colletotrichum* viz. *C. capsici*, *C. gloeosporioides*, *C. acutatum* and *C. coccodes* in solo or as disease complex. To identify the resistant / immune germplasm for Anthracnose, the geographical mapping of *Colletotrichum* species is of prime importance.

Methods

Major red chilli growing states in India are Andhra Pradesh, Madhya Pradesh, Telangana, Karnataka, Tamil Nadu, and Maharashtra where it was grown in 5.23 lac hectares in year 2021-22 (Data Source: Spice Board 2021-22) which contributes approximately 75.25% red chilli growing area in India. Thus, an extensive survey was conducted in major chilli growing regions of Central and Southern part of India to assess the incidence and geographical mapping of *Colletotrichum* Species causing chilli anthracnose. An extensive survey was conducted to assess the incidence of anthracnose of chilli from different locations during kharif 2020 from Andhra Pradesh, Karnataka, and Tamil Nadu and kharif 2021 from Maharashtra, Madhya Pradesh, and Chhattisgarh. Chilli samples infected with Anthracnose fruit-rot were randomly collected from 95 chilli farms grown in different hotspot regions from following states. Survey was conducted in Kharif 2020 from Andhra Pradesh, Karnataka, and Tamil Nadu, while in Kharif 2021 from Maharashtra, Madhya Pradesh, and Chhattisgarh. Samples were analyzed based on morphological characters.

Results

After morphological characterization of collected samples, it was confirmed that 80 fields were infected alone with *C. capsici*, 7 fields were infected alone with *C. gloeosporioides* while 8 fields were mixed infected with both *C. capsici* and *C. gloeosporioides*.

Conclusions

Anthracnose infection mainly affect chilli at red fruit stage. Morphological characterization of collected samples from the surveyed region revealed that *Colletotrichum capsici* and *C. gloeosporioides* were the major species infecting chilli while *Colletotrichum capsici* was the predominant species. As *C. capsici* is predominant species causing Anthracnose, we need anthracnose resistant source at least against *C. capsici*. Resistant source against both *C. capsici* and *C. gloeosporioides* will be a boon for breeders to strengthen disease resistance

Keywords: Anthracnose, Fruit rot, Anthracnose Die-back, *Colletotrichum*, *C. capsici*, *C. gloeosporioides*, *C. acutatum*, *C. coccodes*, Anthracnose predominant species, Anthracnose mapping, Geographical mapping.

Analysis of Rainfall trends of 120 Years (1901–2020) of district Karnal Haryana, India**Jasvinder Kaur and Satyakaam Malik***Extension Education Institute, Nilokheri, CCS Haryana Agricultural University, Haryana- 132 117***Purpose**

Climate change and variability have a significant impact on the hydrological cycle, particularly on rainfall. Therefore, it is crucial to investigate changes in the temporal patterns of rainfall dynamics in specific regions to enable appropriate management of water resources at the regional level and to prepare for extreme events such as floods and droughts. This study focuses on examining the temporal patterns of rainfall dynamics in Karnal, as it is an essential aspect of understanding the local hydrological cycle and its potential impacts on water resources management. The results of this investigation can provide valuable insights for policymakers and stakeholders to design and implement effective adaptation and mitigation measures to address the adverse impacts of climate change and variability on the hydrological cycle and associated ecosystems.

Methods

This study aimed to analyze the temporal distribution and performance of seasonal rainfall in Karnal district of Haryana, India. Gridded rainfall datasets covering a span of 120 years (1901 to 2020) were obtained from the India Meteorological Department (IMD). Statistical analyses such as mean rainfall, rainfall deviation, moving-average, rainfall categorization, rainfall trend, correlation analysis, and probability distribution function were applied to the datasets.

Results

The table 1 presents a summary of rainfall data for different seasons in the Karnal district of Haryana, including Winter, Pre-Monsoon, Monsoon, and Post-Monsoon seasons, along with the slope of the innovative trend analysis for each season. The mean rainfall in the winter season in Karnal district is 46.3 millimetres, with a standard deviation of 34.8 millimetres. The slope of the innovative trend analysis for the winter season is negative at -0.16 millimetres per year, which indicates a decreasing trend in rainfall amounts over time. The Pre-Monsoon season in Karnal district has a mean rainfall of 38.4 millimetres, with a standard deviation of 33.6 millimetres. The slope of the innovative trend analysis for the Pre-Monsoon season is positive at 0.16 millimetres per year, which suggests an increasing trend in rainfall amounts over time. The Monsoon season in Karnal district has a mean rainfall of 529.1 millimetres, with a standard deviation of 173.2 millimetres. The slope of the innovative trend analysis for the Monsoon season is negative at -0.69 millimetres per year, indicating a decreasing trend in rainfall amounts over time. Finally, the Post-Monsoon season in Karnal district has a mean rainfall of 28.6 millimetres, with a standard deviation of 37.9 millimetres. The slope of the innovative trend analysis for the Post-Monsoon season is negative at -0.2 millimetres per year, indicating a decreasing trend in rainfall amounts over time. All of the trend values in the innovative trend analysis are statistically significant at a 1% significance level ($p < 0.01$), which means that the observed trends in rainfall amounts over time are unlikely to have occurred by chance.

Overall, the data suggests that Karnal district experiences varying patterns of rainfall amounts in different seasons, with decreasing trends in rainfall amounts observed in winter, Monsoon, and Post-Monsoon seasons, while an increasing trend is observed in Pre-Monsoon season. These trends could have significant implications for agriculture, water resources, and other sectors that depend on rainfall patterns in the region. Further analysis and interpretation would be required to fully understand the causes and potential impacts of these trends, including the influence of climate change and other environmental factors.

Table 1: Descriptive statistics of seasonal rainfall.

Season	Mean Rainfall (mm)	Standard Deviation (mm)	Slope of Innovative Trend Analysis (mm/year)
Winter	46.3	34.8	- 0.16 **
Pre-Monsoon	38.4	33.6	0.16 **
Monsoon	529.1	173.2	- 0.69 **
Post-Monsoon	28.6	37.9	- 0.2 **

** Trend at 1% significance level ($p < 0.01$)

Conclusions

The results of this study provide a detailed analysis of the qualitative and quantitative aspects of seasonal rainfall dynamics for Karnal district in Haryana state. The findings offer important insights into the impact of climate change and variability on rainfall dynamics in the region. These insights can be valuable for policymakers and stakeholders in making informed decisions regarding the optimization of hydrological resources in response to changing climatic conditions. By providing a comprehensive assessment of the historical patterns of rainfall dynamics in Karnal, this study can inform the development of effective water resource management and climate adaptation strategies that are tailored to the specific needs of the region.

Keywords: Rainfall, Trends, Karnal, Haryana

Role of Microfinance in Agricultural Entrepreneurship Development: Case studies of Nepal Uday Raj Khatiwada, Member of BOD

Swarojgar laghubitta bittiya sanstha ltd. (self-employment microfinance organization) a nbfc runned by private sector Banepa-5, Kavrepalanchok District, Nepal, 00977-11-661060

Abstract

Microfinance is the provision of financial services to low-income people. Where Entrepreneurship has been described as the "capacity and willingness to develop, organize and manage a business venture along with any of its risks in order to make a profit. With the combination of Microfinance and Agricultural Entrepreneurship a lot of work can be done. In this study Microfinance can play a vital role for Agricultural Entrepreneurship through financing for production and different types of value addition activities. Where small farmers / low income people can generate self employment. Side by side Agricultural Entrepreneurship also support Microfinance through wide verities of production and value addition activities to use this tool. A lot of examples has seen on various activities. In a case study of potato farming , A women earns 200% profit farming within 4 months. In annual term it reaches 600% . Which show the high potentiality of Agricultural Entrepreneurship . In conclusion Microfinance and Agricultural Entrepreneurship together can make synergical effect to eradicate poverty by creating various types of self employment and business opportunities . By these opportunities small farmer and low income people generate income and enhance their prosperity, side by side it conserve the environment.

Key Words

Microfinance, Agricultural Entrepreneurship, Small farmers, Business products, Income, Eradicate from production side, enhance the quality of life from consumption side, Women friendly business, Prosperity, conserve the environment.

Objectives

The objective of this presentation is to show, What is Microfinance and how it works. Side by side to explore the potentiality of Agricultural Entrepreneurship. What are the Agricultural business are going on with support of Microfinance. At last how both can produce synergical effect to create the agricultural business opportunity for small farmers and low income people.

Under mentioned Details.

Defination of Microfinance

Microfinance is the provision of financial services to low-income people. It refers to a movement that envisions a world where low-income households have permanent access to high-quality and affordable financial services to finance income-producing activities, build assets, stabilize consumption, and protect against risks.

Definition of Entrepreneurship

Entrepreneurship has been described as the "capacity and willingness to develop, organize and manage a business venture along with any of its risks in order to make a profit.

Role of Microfinance for Agricultural Entrepreneurship Development.

Microfinance can finance for producing any Agricultural Business products. Where small farmers / low income people can generate self employment.

Microfinance can finance for trading of any Agricultural Business products.

Microfinance can finance for storage / warehousing of any Agricultural Business products.

Microfinance can finance for transportation of any Agricultural Business products.

Microfinance can finance for refinement of any Agricultural Business products.

Microfinance can finance for any type of value chain development/ linkage of any Agricultural Business products.

More importantly Microfinance can make a linkage of small farmers / low income people /real poor people for production , trading & other various value chain activities for any Agricultural Business products.

At last by generating income through various activities Microfinance creates a large number of consumers for any Agricultural Business products.

Role of Agricultural Entrepreneurship for Microfinance Development.

Microfinance it self is a tool, but without the work /proper work the tool is useless.

Agricultural Entrepreneurship prepares a ground for the use of tool, called Microfinance.

Agricultural Entrepreneurship can gives a wide varieties of Production for Human Needs.

Through wide varieties of Agricultural Production, People get employment from various types of value chain activities.

Through various types of value chain activities, people gets earning.

Through the earning people/family survive.

In this way directly or indirectly Agricultural Entrepreneurship can become the base for Micro financial/ Micro trading activities.

Microfinance wants more from Agricultural Entrepreneurship side

NEW DIMENTIONS OF EMPLOYMENT for HIGH PRODUCTION.

QUALITY PRODUCTION.

FAST (COMPARATIVELY LESS TIME CONSUMING) PRODUCTION.

LOW WASTAGE PRODUCTS.

HIGH NUTRITIOUS PRODUCT DEVELOPMENT.

COST EFFECTIVE PRODUCTS.

MORE PRESERVATIVE TIME GAINED PRODUCTS.

VARIOUS TYPES OF VARIETIES OF ANY PARTICULAR PRODUCTS. (like “Dried apple chips”)

AGRICULTURAL ENTREPRENEURSHIP ACTIVITIES WITH SUPPORT OF MICROFINANCE IN NEPAL

In eastern Nepal small farmers are taking Microfinance loans for planting Tea plants. This is a single time investment & long term cash crop income. In hilly areas of Nepal small farmers are taking Microfinance loans for planting Orange plants. This is a single time investment & long-term cash crop income. In eastern Terai of Nepal, small farmers are taking Microfinance loans for planting jute plants. This is a single time investment & single time cash crop income. In western Nepal small farmers are taking Microfinance loans for planting Apple plants. This is a single time investment & long-term cash crop income. In all over Nepal small farmers / low income families are taking loans for various types of vegetable farming . It is a sustainable & regular income for families. In all Nepal low income people are doing vegetable & fruit selling/ vending activities & making money. In all Nepal low income people are getting self employment from various Agricultural business activities.

In all over Nepal Pumpkin shoots is testiest vegetable & women sell pumpkin shoots & other leafy vegetables . A number of women’s are involve in this business.

Agricultural Entrepreneurship gives self-employment for poor family members.

Agriculture production , trading or any type of value chain addition activities are more women friendly . Through this women’s are getting socio economic up liftment.

A case study of Potato farming in Kavrepalanchok District of Nepal

A poor village women came to swarojgar bank to became member so that she can borrow the loan. Up to Nrs. 50,000/-.

During interaction she told that neither she has any business nor she has any business idea.

Then she told about her family situation. Where they have four member in family, Husband works as a daily wage worker, They lives on survival agriculture.

At last she declare that they grow potato for cash.

She told that they get 3 times income then their investment in 3 to 4 monts. (for instance if she invest Nrs.50,000/- she can make Nrs. 1,50,000/- through potato production.)

This is the main point for microfinance from entrepreneurship side. This is a great business idea. Because there is 2 times (200%) profit within 3-4 months. If we calculate at annual term it is $2*3=6$ times (600 %) profit .

After potato farming, she wants to make potato chips so that she can earn more. Due to the value addition. (for this she want small loan)

In this way combination of Microfinance & Agricultural Entrepreneurship, it becomes a boon for low income people.

Here Microfinance gives financing for low income people & Agricultural Entrepreneurship gives wide verity of production, trading , any types of value chain activities or value addition activities.

In this way low income people gets self employment & earning .

At last it becomes a tool for women’s socio economic upliftment tools. Which is sustainable also.

Conclusion

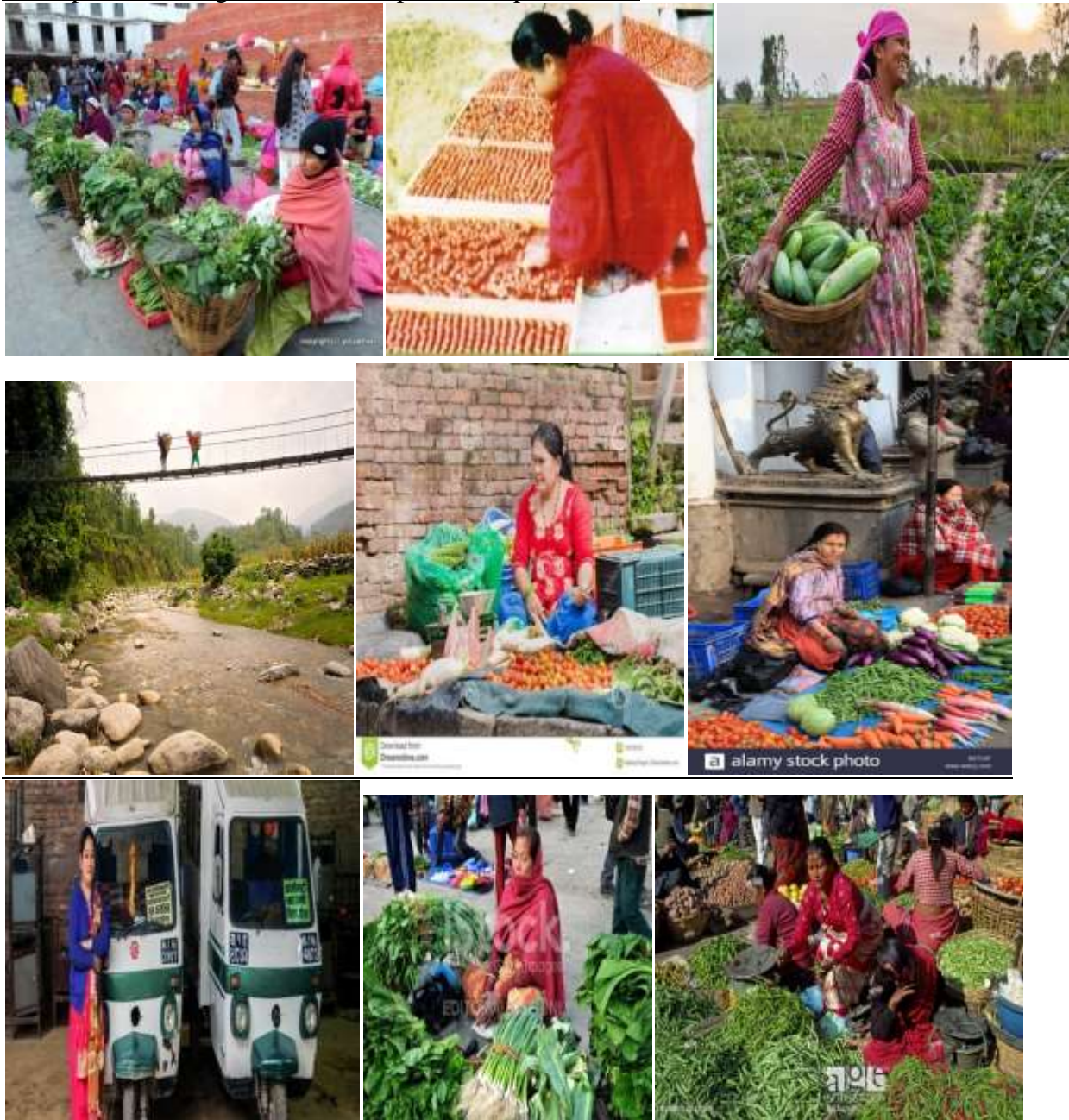
Microfinance & Agricultural Entrepreneurship together can make synergical effect to eradicate poverty from production side & enhanced the quality of life from consumption side from all over the world.

Microfinance & Agricultural Entrepreneurship together can make synergical effect for countless self-employment creation.

Microfinance & Agricultural Entrepreneurship together can make synergical effect for women development through women’s participation at wide verities of business.

Microfinance & Agricultural Entrepreneurship together can make synergical effect to make prosperous world.

Some pictures of Agricultural Entrepreneurship Business.





Consequences of Climate Change on Health and Socio-economic Factors: A Case Study of Vadodara City of Gujarat

Shilpi Saraswat

Department of Family and Community Resource Management, Faculty of Family and Community Sciences, The Maharaja Sayajirao University of Baroda, Vadodara

Purpose

Climate change occurs over decades or longer time scales, and its effects on the environment are already visible. The Western Indian states of Gujarat are also subject to the vagaries of climate change. Climate change continues to have an impact on human health and socio economic aspects. Increase respiratory and cardiovascular diseases, injuries and premature deaths from extreme weather events. Climate change also have impacts on socio economic aspects by adding additional burden of expenses on medicines, electricity etc. therefore by keeping all the aspects into consideration, the present research was undertaken to find out the change in local climate, particularly extreme weather events, to find out the effect of urbanization on local land surface temperature and possibility of urban heat island effect through remote sensing, and to find out the effect of climate change on physical health and socio economic aspects of the residents of different areas of Vadodara city.

Methods

Descriptive research design was used to find out effect of climate change on physical, mental health and socio economic aspects. The locale of the study was Vadodara city of Gujarat which was divided into four zones viz. East, West, North and South. Total 34 areas selected for the survey

through Multi-stage sampling. The permission from Municipal Corporation was taken to interview 10,000 respondents selected through convenience sampling.

Results

The results showed that human thermal discomfort is rising with statistically significant increase in danger Heat Index days. Further it also revealed that danger HI days is high not only on May but in June also. In the month of March and April, there are number of extreme caution days. The number of heatwaves events, the length of the longest heat waves and total number of days that contribute to individual heat waves have rising trends. The findings also revealed that the daily normal temperature has increased which have direct impact of climate change. The impact on health aspects revealed that people suffered from diseases such as Chikenguniya, dengue, typhoid from August to October months. The cases of heat stroke have also mounted during summers. Due to unexpected floods people faced huge loss of money, property, relative's deaths, education, food, agriculture crops. They also suffered from vector and water borne diseases during this time. Due to rise in temperature, people are investing more on Air-conditions and room coolers which is additional economic burden on them.

Conclusions

The findings revealed the average rise in temperature which is resulting in health related issues and increase in economic burden. Therefore, it is suggested to increase the green cover. Here the NGO's and educational institutions can join hands to create awareness among the masses about impacts of climate change. Although the government have laid down several policies and mitigation strategies to combat climate change. The policy changes are recommended for banks, schools and public office timings. Early morning hours, late evening hours can be considered as office or working hours in order to protect from severe heat during afternoon and increased efficiency in work.

Keywords: climate change, health impacts, socioeconomic impacts, extreme weather events, heat island effect, increasing temperature

Income Analysis of Production of Tomato in Karnataka

Manohar, B. H.* and Balachandra K. Naik.

Department of Agribusiness Management. University of Agricultural Sciences. Dharwad. 580 005

Introduction

Tomatoes are the major vegetable producing in Karnataka which has been utilized for preparation of curries as well as salad purpose during recent years. The study concentrated on how the farmer's income had been enriched by adoption of advanced production technologies. Hence, the study aimed with the specific objective of economic analysis of tomato production.

Methodology

The present study aimed to analyze the economics of tomato production in major tomato producing belts of Karnataka. The open and protected cultivation of tomatoes was concentrated in the study. Kolar from South Karnataka and Belagavi from North Karnataka was the leading producer of tomatoes in the state. Hence, these two districts were selected. The study was conducted during the year 2021-22 in Karnataka. Primary data pertaining to the study were collected from 15 farmers each under open and protected cultivation practices in Kolar and Belagavi districts of Karnataka with the help of structured schedule. The random sampling and snowball sampling method was adopted for selection of farmers who are practicing open and protected cultivation of tomatoes respectively. The capital budgeting technique was adopted for analysis of data.

Results

The results revealed that the total cost required for cultivation of tomatoes under open cultivation was around Rs. 2,43,929 per hectare. The gross returns and net returns gained by the open cultivation of tomatoes was Rs. 5,75,418 and Rs. 3,31,490 respectively with the benefit-cost ratio of about 2.36. While under protected cultivation, the total cost was around Rs. 4,11,081 per ha. About Rs. 10,00,932 per ha was obtained as the gross returns and net returns of Rs. 5,89,851 with the benefit-cost ratio of 2.43. About 68.52 per cent of higher capital required for protected cultivation, in turn provides the higher net returns of 77.93 per cent.

Conclusion

Therefore, it could be concluded from the requirement of capital is higher under protected cultivation as well as net returns also. But the marginal farmers in the study area are not capable to establish the protected structure, for those farmers open cultivation is the better option. The farmers those who are having the sufficient funds can establish protected structure and adopt the protected cultivation of tomatoes.

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Effect of elevated carbon dioxide and temperature on growth and yield in groundnut (*Arachis hypogaea* L.) genotypes

Manjunath, S¹., Shakunthala, N. M²., Basave Gowda³., Doddagoudar, S. R⁴., Prabhuraj, A⁵.
Purpose

Four genotypes of groundnut (*Arachis hypogaea* L.) viz., K-9, TMV-2, GPBD-5 and R2001-2 were raised in open top chambers at elevated carbon dioxide and elevated temperature (550ppm and 2 °C respectively) during *Rabi* 2016 to investigate the effect of raised levels of CO₂ and temperature on various growth and yield parameters. The plant height, chlorophyll content, leaf area index, number of nodules, test weight and seed yield per plant were recorded highest under treatment T₄ (elevated CO₂ and elevated temperature). Similarly, negative impact on growth and yield parameters under treatment T₅ (elevated temperature) high temperature decreased the growth parameters. There was significant interaction of elevated CO₂ and elevated temperature on vegetative growth. The beneficial effects of increased CO₂ on photosynthesis and growth were overwhelmed by the negative effect of high temperature on growth.

Methods

An investigation was carried out to study the effect of elevated levels of CO₂ and temperature on growth of groundnut under Open Top Chamber (OTC's) at Main Agricultural Research Station (MARS), University of Agricultural Sciences, Raichur, Karnataka. The five treatments (Control condition, Reference chamber (390ppm CO₂), 550 ppm carbon dioxide, 550 ppm carbon dioxide + 2⁰C rise in temperature and 2⁰ C rise in temperature) along with four genotypes (K-9, TMV-2, GPBD and R2001-2) were laid out in pots as two factorial completely randomized design with three replication during *rabi* season 2016. The present investigation was carried out during *rabi* season of 2016 at Main Agricultural Research Station Raichur (MARS), Raichur, which is situated in the North Eastern Dry Zone (Zone-II) of Karnataka between 16⁰ 15' N latitude and 77⁰ 20' E longitude with an altitude of 389 m above the mean sea level.

Results

In the investigation during grand growth period *i.e.* 60 DAS, plants grown under elevated CO₂ at 550 ppm with elevated temperature (2 ° C rise) (T₄) recorded highest plant height (36.19 %), number of nodules per plant (24.12 %), chlorophyll content (46.64) and leaf area index (95.83 %) when compared with ambient CO₂ with ambient temperature (T₂) (control OTC). This drastic increase in growth parameters is function of elevated CO₂. However, there is decrease in growth parameters too *i.e.* plants grown under ambient CO₂ with elevated temperature (2 °C rise) (T₅) has recorded decreased of plant height (10.86 %), number of nodules per plant (11.53 %), chlorophyll content (41.28) and leaf area index (36.96 %) when compared with ambient CO₂ with ambient temperature (T₄) (control OTC).

Genotype TMV-2 showed little higher leaf area index, canopy temperature and chlorophyll content at harvest as compared to K-9. This might be due to fast growing, bushy and spreading habit of genotype which progressively increased in branching. Further, the differential behaviour among the genotypes could be explained solely by the variation in their genetic makeup and their differential behaviour under different climatic conditions. Genotype TMV-2 recorded comparatively maximum plant height and proved significantly superior to rest of the genotypes. This might be due to erect growing habit of genotype TMV-2 which resulted in vertical growth rather than horizontal spread of plants. Tripathy *et al.* (1999) and Virendra *et al.* (2008) at different locations also reported differential growth behaviour of groundnut genotypes in terms of plant height, canopy temperature, number of nodules per plant, leaf area index and chlorophyll content were found to be higher in genotype TMV-2 than K-9, indicating the healthiness of plants, dark green natured leaves and higher chlorophyll content than genotype TMV-2.

Conclusions

The study revealed that all the genotypes where shown significant variation with respect to growth aspects. However groundnut shown positive performance under elevated CO₂ conditions, compared to elevated temperature conditions. The genotype TMV-2 performed well compared to K-9 under treatment T₄(elevated CO₂ + elevated temperature) showing highest plant height, number of nodules and leaf area index. Similarly negative impact on growth parameters under treatment T₅ (ambient CO₂ and elevated temperature) among the genotypes TMV-2 performed better than K-9 and other genotypes. Study helps to select suitable genotype for varying climatic conditions.

Keywords: Climate change, Elevated CO₂, Temperature, Ground nut and OTC

Socio-Economic Impact of Drip Irrigation on Farmers for Sustainable Horticulture Development

Vinod Kumari*, Subhash Chander and Kushagra Prasad

Department of Sociology, CCS Haryana Agricultural University, Hisar-125004, Haryana

Purpose

A contextual sentence about your motivation behind your topic.

Water scarcity is becoming more prevalent, limiting agricultural development in India and throughout the world. The solution to the water problem is through management practices by efficient use of the available water both in the short-run and long-run perspectives. One of management mechanisms is the adoption of micro-irrigation such as drip and sprinkler methods of irrigation. Drip irrigation effectively delivers water directly to the root zone and reduces water wastage and is considered a feasible alternative for crops requiring a lot of water.

Methods

A descriptive statement about the types of literature used in the review.

The drip method helps in achieving saving in irrigation water, increased water-use efficiency, decreased tillage requirement, higher quality products, increased crop yields and higher fertilizer-use efficiency. MIS is viable for horticultural crops and orchards as it increases yield and a significant rise in crop value for high valued crops. The objective of the present study was to know the adoption and impact of Drip irrigation as an efficient water use technology in citrus crops for sustainable crop production. In this paper, intensive research works by different researchers as well as by the authors regarding drip irrigation technology in citrus crops have been reviewed and discussed so that a definite perception may be generated for the farmers as well as future researchers

Summarize and findings

Drip irrigation is a type of irrigation system that delivers water directly to the roots of plants in small, precise amounts, through a network of tubes and emitters. This irrigation method is particularly useful in horticulture, as it provides a consistent water supply to plants, which is essential for their growth and productivity. Farmers have shifted to Horticulture, Floriculture and other alternate forms of farming practices over time. This can be gauged by the fact that the horticulture produce has surpassed the food grain production in the country while offering higher productivity. This higher productivity, therefore, has led farmers to shift towards a more profitable sector within agriculture. Also, the high-end use of drip irrigation systems in horticulture crops has made them more environmentally sustainable as compared to traditional agricultural crops. The increased profits for farmers at large have made drastic changes in their lifestyles and day-to-day activities. With increased access to better education and health facilities, farmers are able to live a commanding life. The paper, therefore, looks at the extent of horticulture and DIS in India and its related impact on the socio-economic conditions and behaviour of farmers in the country.

Conclusion

On the whole, it was found that factors like age, general caste status, level of education, size of landholdings, mass-media exposure and socio-economic status played an important role in the adoption of drip irrigation in citrus crops. There is a need to improve, mass-media exposure, extension contacts and training and education, etc. in rural areas to improve the adoption level of drip irrigation among farmers. There is a need to address the constraints faced by farmers to improve the adoption and impact of drip irrigation among farmers. This water-saving technology must be extended to all regions to elucidate the benefit of drip irrigation through proper extension services so that farmers can get higher crop productivity using limited resources of water and also benefit economically.

Key Words- Horticulture crops, Drip Irrigation, Socio-Economic Impact.

Water Storage Assessment of Khapri Watershed Through Geospatial Techniques

A.L.Guruji, P.G. Agnihotri

Civil Engineering Department, Polytechnic, The M.S. University of Baroda, Fateh Gunj, Vadodara-390002

Purpose

Khapri watershed is mountainous region having average 2255 mm rainfall every year. In the last few months of hydrological year i.e. April & May, there is an acute shortage of drinking water. To overcome this short fall, it is necessary to manage natural watersheds available in the region. water harvesting is a system that collects rainwater from where it falls around its periphery rather than allowing it to go as runoff. The strategy of “Think Globally, Act Locally” should be used in this area for management of water. Local water that is rainwater stored using Rainwater Harvesting

Structure and Conservation used optimally before it goes in drain or river. The subsurface reservoirs are very attractive and technically feasible alternatives for storing surplus monsoon runoff. But in the study region, this is not possible as there is a basalt rock. Recharging is not advisable as water table in post monsoon just touches ground level. So, Rainwater harvesting structures for direct use of water may be the possibly best solution. For community requirement rainwater may be stored in checkdams or depressed area naturally available. Construction of small barriers across small streams to check and store the running water also can be considered as water harvesting structure. This may fulfil the drinking water requirement of their cattles.

Check dams in the watershed has been ascertain using Geospatial techniques and few of them verified by visiting the sites. In site visit it is found that open wells near the stream has water level above stream water level. At few places farming is done in check dam reservoir or in stream itself

Methods

A. Water Storage Structures using RS-GIS

The Khapri watershed is highly hilly region with steep slope. This site is not favorable for recharging structure as in last face of monsoon ground water level in almost all open well touches ground level. So, checkdams may be constructed and here one hundred and twelve checkdams has been identified using Remote Sensing Techniques. checkdams are very clearly observed and they are demarcated using line tool available in this software. Lines are marked on visible checkdam and that line is stored in .kmz format . This file again open in QGIS 3.8 version, and then .kmz Format file converted in the shape file. This file can be open in any other compatible software for further analysis. Such 112 checkdams are identified in watershed and stored in .shp format. The length of all checkdams stored in this file with it's location. This has been ascertain using GPS hand held tool and all are shown in Fig.1.

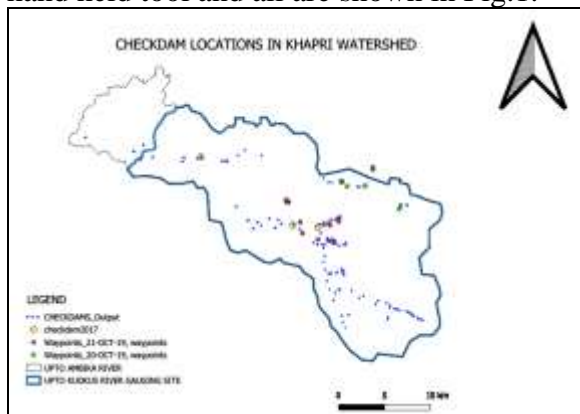


Figure 1 Checkdam locations in Khapri watershed

B. Depression Analysis using contour map of watershed

In this method using DEM (Digital Elevation Model) of study area, contour map generated and with interval of 5 m contour lines, analyze whole area where natural depression available in the watershed. By this way there are about 25 sites found in this area where natural depression available. Few of them are in river valley itself and few are at top of hilly region. For constructing Rainwater Harvesting Structure such depression are advantageous. These depressions are marked in QGIS using polygon function and a shape file has been generated. These sites are shown in Fig. 2.

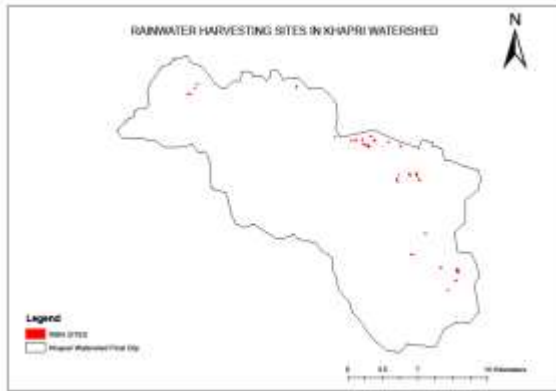


Figure 2 Rainwater Harvesting sites in Khapri watershed

As a part of checking the remotely sensed data, field verification has been done. GPS points are collected using hand held GPS instrument on 20th and 21st October, 2019. The waypoints in .gpx format extracted from instrument and call in QGIS using Vector tool bar. It will display points on screen and it will look like Figure 1. Figure 3 shows half of checkdam reservoir filled with clay and cultivation has been practiced in that area. Fig. 4 shows one side of stream near causeway practiced for cultivation. Fig. 5 shows water level in open well above stream water level. Figure 6 shows water level in open well touches almost ground level.



Figure 3 Half of Checkdam covered with Cultivation



Figure 4 One side of causeway stream filled with cultivation



Figure 5 Water Level in Open well near stream above River Water Level



Figure 6 Water level in Open well almost touching Ground level in Ahwa (21st october,2019)

Results

From depression analysis of Contour map of watershed there are about 25 water harvesting spots from which few are following in river valley itself.[Fig.2]

There are 112 checkdams identified from geospatial technique and few are verified with GPS hand held instrument.[Fig.1]

From site visit, it is observed that one check dam reservoir filled with clay and used for farming.[Fig. 3]

At other location in the watershed, one side of causeway, farming done in stream and other side water is flowing.[Fig. 4]

Above third and fourth point clearly indicate the heavy erosion and settlement in the stream which is alarming.

Few of open wells observed in the watershed, in the month of October, i.e.post monsoon season, they are almost touching to ground level. One open well near stream, water level is higher than stream water level.[Fig. 5],[Fig. 6]

The above sixth point indicates that there is very little scope for recharging ground water.

Conclusions

From result and site visit, rainwater may be efficiently stored in streams itself and recharge to ground water is not possible as after monsoon ground water level touches the almost ground level. The technique of rainwater harvesting to collect the rain from localized catchment surfaces such as roofs, plain /sloping surfaces for direct use(Rooftop Rainwater Harvesting System,(RRHS))for individual family may be suggested to overcome drinking water problem in last two months of hydrological cycle.[1],[2].

Keywords: Check dams, Rainwater Harvesting Structure.

Transfer of climate change technologies through innovative programmed instruction method to Extension functionaries

Manjula, N¹., Chandregowda, M.J²., Nagaraja, N³. Srinivasa Reddy, M.V⁴.

¹ Dept. of Agric. Extension, College of Sericulture, Chintamani, UAS Bangalore, Karnataka, India

² Agric. Extension, ICAR-ATARI, Zone-XI, Bangalore, Karnataka, India

³ Director of Extension (Retd.), University of Agricultural Sciences, Bangalore, Karnataka, India

⁴ Dept. of Agric. Extension, College of Sericulture, Chintamani, UAS, Bangalore, Karnataka, India

Introduction

There is a constant effort from the research system to develop new mitigation and adaptation technologies to address the problems of climate change in agriculture. These technologies should be made available to the extension functionaries within a reasonable time for advocating such technologies to the farmers who are end users. One of the conventional methods to disseminate new agricultural technologies to extension functionaries are lecture methods through trainings. In lecture method, learner will be a passive receiver of the information and there are more chances of missing the information due to socio-psychological reasons. While searching for new educational approaches, Programmed Instruction (PI) was found to be unexplored approach in agricultural extension education. The PI is a learning methodology proposed by the behaviourist Skinner (1958) based on operant conditioning theory, which states that the learning is change in behaviour, i.e. the individual's response to events or stimuli. Behaviour can be conditioned by rewarding the right stimulus-response patterns. Dale (1945) defined that PI is a systematic, step by step, self-instructional program aimed to ensure the learning of stated behaviour. The PI is a method of presenting new subject matter to learners in a graded sequence of controlled steps. Learners work through the programmed material by themselves at their own speed and after each step, test their comprehension by answering questions as well, they can find the correct answer immediately. Owing to its strengths, an attempt has been made to develop PI material on new and very important agricultural technology-climate change, impact, mitigation and adaptation strategies in agriculture. A comparison study was conducted to evaluate the effectiveness of PI and Lecture methods in educating extension functionaries with respect to change in the cognitive and affective domains.

Material And Methods

The experiment was conducted in the Staff Training Unit of University of Agricultural Sciences, Bangalore during trainings organised to Extension Functionaries of the Karnataka State Department of Agriculture (KSDA) using Solomon four group experimental design: before-after with three controls. The sample for each of PI and Lecture method consisted of four groups with 30 extension functionaries in each group and hence, a total of 240 extension functionaries constituted the sample respondents for the study.

For investigation, the PI material consisting of 65 frames was developed using the linear method of programming on the contemporary subject, 'climate change, its impact, mitigation and adaptation strategies in agriculture'. The readability of PI material was found to be at IX grade indicating that the persons with ninth standard and above can easily read and understand. The scales were developed to measure cognitive and affective domains of extension functionaries which provided an insight into learner's level of learning in the hierarchy of sub-domains of cognitive and affective domains.

Results

Results of t test presented in table-1 revealed that there was a significant difference between effectiveness of PI and lecture methods with respect to acquisition of learning on sub domains of

cognitive and affective domains. With respect to overall cognitive domain, effectiveness in PI method (45.17) was significantly higher than the lecture method (32.83). Further, results relating to sub-domains of the cognitive domain revealed that, highest effectiveness score was observed in evaluation sub domain (52.33 in PI and 37.17 in lecture method) followed by synthesis sub domain with mean effective score of 48.17 in PI and 35.83 lecture method, Knowledge sub domain with mean effective score of 47.83 in PI and 32.33 in lecture method, analysis sub domain with mean effective score of 47.00 in PI and 36.33 in lecture method, comprehension sub domain with mean effectiveness score of 38.50 in PI and 25.67 in lecture method and application sub domain with mean effectiveness score of 37.17 in PI and 29.67 in lecture method indicating PI method of instruction is superior over lecture method in influencing sub domains of cognitive domain.

Similarly, results with respect to affective domain clearly revealed that the overall affective domain effectiveness was significantly better in PI method (41.36) compared to lecture method (35.43). It was observed that PI method tend to possess higher levels of effectiveness than lecture method in all the sub-domains of the affective domain of extension functionaries. The highest mean effectiveness score was observed in Organization sub-domain (51.00 in PI and 42.13 in Lecture method). This was followed by valuing sub-domain with mean effectiveness score of 42.87 in PI and 37.13 in Lecture, Responding to phenomena sub-domain with mean effectiveness scores of 39.60 (PI) and 34.33 (Lecture), Receiving phenomenon with mean effectiveness score of 38.00 (PI) and 33.93 (Lecture) and Internalizing values with mean effectiveness scores of 35.33 in PI and 29.60 in Lecture methods indicating that, the PI is an effective method over Lecture method in influencing the affective domain of extension functionaries.

Table 1: Comparison of effectiveness of PI and lecture methods on cognitive and affective domain of extension functionaries

Sl. No.	Domain / Sub- domain	Effectiveness scores		P (T ≤ t)	t value
		PI	Lecture		
1.	Cognitive Domain				
1.1	Knowledge	47.83	32.33	0.0001	4.14 **
1.2	Comprehension	38.50	25.67	0.004845	2.93 **
1.3	Application	37.17	29.67	0.031965	2.20 **
1.4	Analysis	47.00	36.33	0.023647	2.32 **
1.5	Synthesis	48.17	35.83	0.003344	3.06 **
1.6	Evaluation	52.33	37.17	0.004638	2.95 **
	<i>Overall cognitive domain</i>	<i>45.17</i>	<i>32.83</i>	<i>0.001</i>	<i>6.44 **</i>
2.	Affective Domain				
2.1	Receiving phenomena	38.00	33.93	0.046234	2.04 **
2.2	Responding to phenomena	39.60	34.33	0.088733	2.17 **
2.3	Valuing	42.87	37.13	0.022699	2.34 **
2.4	Organisation	51.00	42.13	0.000879	3.51 **
2.5	Internalising values	35.33	29.60	0.010477	2.65 **
	<i>Overall affective domain</i>	<i>41.36</i>	<i>35.43</i>	<i>0.00001</i>	<i>5.51 **</i>

** Significant at 1 per cent level

Conclusions

The comparison of PI and Lecture methods clearly illustrated that PI is superior over Lecture method and has significant effect on the cognitive and affective domains of extension functionaries

on the subject, 'climate change, its impact, mitigation and adaptation strategies in agriculture'. Further, PI was found to be effective at all the sub-domains of cognitive and affective domain in acquiring new technology. Therefore, the PI material can be best utilized to educate extension functionaries on the new agricultural technologies emerging from time to time. PI can also be used for modifying the intellectual abilities and skills of the literate farmers on new agricultural technologies like protected cultivation, secondary agriculture etc., which intern drive them towards adoption of these technologies.

Keywords Programmed Instruction, Mean effectiveness score, Lecture Method, Cognitive domain, Affective Domain, Sub domains, Extension Functionaries

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Characterization of Job's tears (*Coix lacryma jobi* L.) germplasm using morphological and SSR markers

Bharati Lap, Magudeeswari P

College of Post Graduate Studies in Agricultural Sciences, CAU, Umiam, Meghalaya

Purpose

Job's tears (*Coix lacryma* L.) is an underutilized crop belonging to the Poaceae family. It is a good source of food and medicine. It has higher antioxidant and nutritional properties. Assessment of genetic diversity for proper characterization of *Coix* germplasm is important to detect the genetic variation present and for discrimination of accessions is necessary for its future use. Aim of this study was to characterize the landrace collections of Job's tears using agro-morphological traits, biochemical traits and SSR markers.

Methods

A total of 65 accessions including landraces and wild cultivars were characterized based on the morphological traits and 16 SSR markers. Biochemical estimation of protein, antioxidant, phenol and flavonoid was also carried out. Proteins extracted from *Coix* seeds were also subjected to SDS-PAGE.

Results

Wide variations for various agronomic traits were observed among the accessions. Correlation indicated that grain yield per plant was positively and significantly correlated with inflorescence length, no. of tillers/plant, no. of brace roots/tiller, girth of tillers, no. of leaves/tiller and 100 seed weight. Phenol content was positively and significantly correlated with flavanoid content and total antioxidant. Accessions were grouped into 5 clusters in UPGMA dendrogram based on Manhattan distance. Marker GBssrJT198 was found to be the most informative locus.

Conclusions

Collection, evaluation, documentation, utilization and conservation of Job's tears germplasm are essential for both sustaining present level of production as well as to meet the need and aspiration of the future generation. More elaborate collections from the Indian subcontinent are to be done to capture the diversity existing for Job's tears and also to add more accessions from under-reported, diversity rich regions. There is also a need to develop more polymorphic SSR markers to assess the genetic diversity in the Job's tears collection.

Keywords: *Coix*, accessions, morphological, SSR markers, genetic diversity

Cotton hybrid preference and Seasonal fluctuation of sucking insect pests with respect to Agrometeorological parameters under Punjab conditions**Amandeep Kaur and Vijay Kumar***Department of Entomology, PAU, Ludhiana, Punjab***Purpose:**

Cotton is an important cash crop of Punjab covering an area of 2.49 lakh hectare with production of 6.39 lakh bales with average yield of 4.36 quintal lint per hectare. Introduction of Bt cotton in Punjab in 2005 led to drastic reduction in bollworm incidence and pesticide load but sucking pests were on the rise. Among these, outbreak of whitefly and thrips was recorded 2015 and 2017, respectively in cotton agro ecosystem of Punjab.

Methods:

Present study was conducted at PAU, Ludhiana during *kharif* 2022. Various Bt and non Bt cotton cultivars (H 777, SP 7172, RCH 773, RCH 776, RCH 926, US 71 and F 2228) were grown under unprotected conditions. Incidence of sucking insect pests was recorded at weekly interval from ten plants per three leaves in agreement with standard meteorological weeks and subjected to correlation analysis.

Results:

The incidence of leaf hopper and whitefly remained active throughout the season with mean population ranged from 1.89-3.03 and 3.06-5.24 per three leaves. The thrips population varied from 2.54-6.16 per three leaves. RCH 776 recorded maximum population of leaf hopper whereas SP 7172 supports highest population of whitefly among the Bt cotton hybrids. The leaf hopper population attained its peak activity period during SMW 31 (4th week of July) and 34 (3rd week of August). The population of whitefly and thrips attained the peak activity period during 3rd week of July and 4th week of June, respectively. Maximum population of spiders was recorded during 28stSMW, respectively.

Conclusion:

Cotton hybrids RCH 776 and SP 7172 recorded maximum population of leaf hopper and whitefly and July and August are the peak activity period for the sucking pests. So monitoring and surveillance should be initiated during June onwards for the timely management of the pests.

Keywords: Thrips, whitefly, leaf hopper, natural enemies, correlation

Standardization of organic potting mixture for Miyawaki forest establishment**J. Resmi*, K.V. Sumiya, E.B. Gilsha Bai, K. Sreelakshmi, A.S. Smijisha and K.V. Arunkumar***Krishi Vigyan Kendra Palakkad, Kerala Agricultural University, Melepattambi, Pattambi-679306 (Kerala), India***Abstract**

‘Miyawaki Model forest patch’ envisages to grow “miniature forests” in every vacant space available in every local body in a systematic and useful manner. A cost effective propagation protocol on potting mixture for growing selected indigenous trees and shrubs were refined for Miyawaki forest patch establishment at KVK Palakkad premises. Seedlings of indigenous trees and shrubs were transferred to polybags or growbags (18’ x 24’ size) containing specific organic potting mixture of 1 kg soil, 4 kg coirpith compost, 2 kg cowdung/ goatmanure/ poultry manure and 5g micronutrient mixture. These plants were aftercared in these bags upto 2 months before

planting in selected area for Miyawaki forest establishment. Planting of such after cared saplings showed to grow with good vigour and created a resilient and thriving forest ecosystem.

Keywords: *Miyawaki Forest, Climate change, organic potting mixture*

Introduction

Climate change is a major concern to Kerala, being one of mega-biodiversity centres of India and its potential impact on the economy, ecology, and environment. Kerala is highly vulnerable to natural disasters and the changing climatic dynamics given its location along the sea coast and with a steep gradient along the slopes of the Western Ghats. Floods are the most common of natural hazard in the state. Nearly 14.5% of the state's land area is prone to floods, and the proportion is as high as 50% for certain districts. Landslides are a major hazard along the Western Ghats in Wayanad, Kozhikode, Idukki, and Kottayam districts. Seasonal drought-like conditions are also common during the summer months especially in Palakkad district. Kerala experienced 66 drought years between 1881 and 2000 (Mishra, V. and Shah, H. L. 2018). Dry rivers and lowering water tables in summer have led to water scarcity both in urban and rural areas. Other major natural hazards are lightning, forest fires, soil piping, coastal erosion, and high wind speed. The state also lies in seismic zone III.

Forests form the basic resource for adaptation in climate change owing to their capacity of carbon sequestration, providing means of keeping the carbon trapped in long term use as wood, harbouring genetic resources and providing ecological services in terms of soil and water conservation. Native forests are much more resistant to disturbances, to changes in the environment, to disasters. They also regenerate soils more quickly. It is observed that carbon storage in forests of India can grow by 10% (6622 million tons (2005) to 7283 million tons of carbon) till 2015.

The contribution of trees outside forests to climate change mitigation can be increased by promoting agroforestry systems and urban forestry. For augmenting the greenery of the state, social forestry has been given a thrust by introducing innovative programmes in schools, colleges, coastal area, and roadside by labour unions etc. This will also help improving the profile and productivity of the forests.

Haritha Keralam Mission, Government of Kerala has launched a new project called 'Pachathuruthu' on June 5, World Environment Day 2019 which aims to grow "miniature forests". It just takes a minimum of one cent of land and a love for greenery to set up a 'Pachathuruthu' (an islet of greenery). From five cent plots to huge acres of land belonging to the government, institutions, private parties and puramboke will be used for the project with the help of the Kerala State Biodiversity Board, Agriculture Department, MGNREGA workers, Forest Department and voluntary organisations. The Green Kerala Mission has formed a team in every district to implement the project.

Taking several hundred years to complete the process of forest restoration is too long for us; because we live in a world where industry and urbanization are developing very rapidly, improvement of an alternative reforestation technique that reduces these times could be a useful tool (Miyawaki, 1999). One reliable forest restoration method is the "native forests by native trees," based on the vegetation-ecological theories (Padilla and Pugnaire, 2006) proposed by Prof. Akira Miyawaki and applied first in Japan in the 1980s. The method compresses layers of a forest—shrubs, trees, canopies—on small plots of land, turning them into tiny forests (Khouzami, 2015). Results obtained by application of the Miyawaki method in about 550 locations in Japan, as well as in Malaysia, Southeast Asia, Brazil, Chile, and in some areas of China, were found to be successful, allowing quick environmental restorations of strongly degraded areas (Schirone et

al., 2011). ‘Miyawaki forest’ envisages to grow “miniature forests” in every vacant space available in every local body in a systematic and useful manner. But there was lack of suitable potting mixture for easy establishment of seedlings in the nursery. Therefore, the present investigation was undertaken to standardize a cost effective propagation protocol on potting mixture for growing selected indigenous trees and shrubs were refined for Miyawaki forest patch establishment at Krishi Vigyan Kendra Palakkad premises.

Materials And Methods

An experiment was carried out at KVK Palakkad of Kerala Agricultural University, Kerala, India during April-June, 2021. This station represents Agro Ecological Sub Region “Western Ghats and Coastal Plain, Hot Humid region (19.2)” of Kerala and geographically situated at latitude 10° 46' 8.00" N and longitude 76° 38' 51.74" E and altitude 94 m above MSL. This belongs to Agro-Climatic Region “West Coast Plains and Ghat Region (XII)” with annual mean rainfall of 1666.60 mm with 135 number of normal rainy days. KVK Palakkad is located in the campus of RARS, Pattambi in the south west part of Palakkad district. A suitable area with good soil conditions (depth, water holding capacity, drainage and nutrient base) was selected as the model demonstration unit of Miyawaki forest patch at KVK campus for implementing the project. Prior to the planting, the site quality was assessed considering the soil, climate, topography, vegetation and water source existing in the area. Soil testing of the selected area was conducted to determine the soil health status. The experimental materials were comprised of organic manures viz., coirpith compost, cowdung, goat manure and poultry manure along with micronutrient mixture. Seedlings of indigenous trees and shrubs were transferred to polybags or growbags (18' x 24' size) containing different organic potting mixture.

Results And Discussion

Considering the importance of *ex-situ* recreation and conservation of forests with native trees, promotion of cultivation of rare, important, indigenous trees as well as medicinal plants through appropriate agro-technologies and awareness creation among rural and urban people in Palakkad district, a Miyawaki Model forest patch was established at KVK Palakkad for representing the entire Palakkad district. The congenial climatic and edaphic attributes of KVK offer a promising platform for creating new vegetation patch almost mimicking the natural forest and maintaining it. Miyawaki forest model envisages local indigenous tree/shrub species in a minimum of 2 cents of land. Saplings planted close together grow rapidly as they compete for light. The major outcome of creation of sustainable greenery demo model is increasing tree population as the first step towards climate resilient farming, conservation of rare and indigenous species, livelihood enhancement as well as ecological restoration as well as awareness generation among people.

Healthy saplings of plants are procured from reliable nurseries, like those run by the Forest Department, KFRI, KAU and are maintained in nursery to become well-rooted. This technique will can effectively bring down the cost. Growing plants in grow bags allows for more effective management of the growing medium; making it easier to manage the soil in which the sapling grows. This ensures the soil is healthy and nutrient rich. Plants are also easier to water and nurse in case of disease when grown in pots. Seedlings of indigenous trees and shrubs were transferred to polybags or growbags (18' x 24' size) containing specific organic potting mixture of 1 kg soil, 4 kg coirpith compost, 2 kg cowdung/ goatmanure/ poultry manure and 5g micronutrient mixture. These plants were aftercared in these bags upto 2 months before planting in selected area for Miyawaki forest establishment.

Forest management practices to increase carbon sequestration like afforestation, reforestation and forest restoration can be achieved through Miyawaki Forest models. With the effective

implementation of the Miyawaki Demonstration unit enriching the flora of selected site with introduction of indigenous trees and medicinal crops offers great invaluable ecosystem services such as water conservation, enhancement of soil fertility, regulating the extremes of temperature, wind etc as well as recreational means to the KVK campus. Carbon sequestration by trees will attract much interest as a mitigation approach, as it has been considered a relatively inexpensive means of addressing climate change immediately. This model of afforestation can be adopted for recreating greenery of Palakkad district destroyed by the recent floods and subsequent drought.

ACKNOWLEDGEMENT

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Effect of biorationals against citrus butterfly, *Papilio* sp. in acid lime, *Citrus aurantifolia* **Dileep Kumar N. T., Biradar A. P., Mallapur C. P., Rakshitha T. N., Saleemali Kannihalli., Sahana M.,**

Department of Agricultural Entomology, College of Agriculture, University of Agricultural Sciences, Dharwad, Karnataka, India, 580005

Purpose

Acid lime, *Citrus aurantifolia* (Swingle) is one of the major fruit crops grown in northern parts of Karnataka. The changing cultivation scenario has led to severe attack of crop by biotic stresses. Among them, insect pests are major concern for limiting acid lime production. Citrus butterfly, *Papilio* sp. is one of economically important insect pest causes significant damage to crop both under nursery and open field conditions. The management of this insect revolves around application of synthetic insecticides. Since crop is having export importance, producing crop with less or nil pesticide residues assumes a greater importance. In this regard, we aimed to evaluate biorationals for the management of citrus butterfly on acid lime.

Methods

The field experiment was carried out using Randomized Block Design during *Rabi* 2020-21 and *Kharif* 2021-22 with seven treatments and untreated check, replicated thrice. The acid lime crop (Var. Kagzi lime) was grown with all the package of practice (except plant protection measures) recommended with row to row and plant to plant geometry of 6 × 6 m. The weekly observations were made to check for incidence of pest. Treatments were imposed when pest reached ETL status. Two applications were taken up with the help of knapsack sprayer at fortnightly interval. To record the incidence of citrus butterfly, from each plant, number of larva was counted; later average number of larva per plant was worked out. The observations on pest density were recorded one

day before and three, five and ten days after imposition of treatments. The data of each spray was pooled and later transformed data was subjected to ANOVA and Duncan's multiple range test.

Results

The outcome of study indicated that plots treated with neem based insecticide recorded significantly less population of citrus butterfly (1.58 larvae/ plant) after two rounds of applications and it was found on par with *Bacillus thuringiensis* 8 L (2.00) and bio digester solution (2.07) in controlling citrus butterfly. The plots treated with pongamia leaf extract, *Beauveria bassiana*, *Prosopis juliflora* leaf extract and thiamethoxam 25 WG recorded 3.38, 3.42, 3.92 and 4.08 larvae per plant, respectively. After two rounds of spray, a significantly higher per cent reduction of larval population was recorded in neem based insecticide (74.54) followed by bio digester solution (71.01), *Bacillus thuringiensis* 8 L (66.12), pongamia leaf extracts (62.36), *Beauveria bassiana* (61.54), *Prosopis juliflora* leaf extracts (57.51) and thiamethoxam 25 WG (57.51).

Conclusions

The biorationals viz., neem based insecticide, *Bacillus thuringiensis* 8 L and bio digester solution (10 %) are highly effective in managing citrus butterfly on acid lime. These biorationals can be used in integrated pest management approach to produce acid lime fruits with less pesticide residues.

Keywords: Biorationals, citrus butterfly, neem based insecticide, *Bacillus thuringiensis*, bio digester solution

Immobilizing Bio fertilizers Using PVA Foams for Soil Fertilization

Suneetha T.B., Navaneeth S Kumar, Kiran R.

Department of Biotechnology Acharya Institute of Technology, Bangalore, Karnataka, India

Purpose

Soil and plant-associated microbes play a key role in ecosystem functioning by carrying out numerous biogeochemical cycles and organic matter degradation. For this reason, bio fertilizers (i.e., microbial-based fertilizers) are considered to be crucial components of sustainable agriculture, with long lasting effects on soil fertility. Three-dimensional matrices for microorganism immobilization promote proliferation, increase biomass and metabolic activity and mimic environmental conditions. Besides increasing tolerance to inhibitors, temperature and pH variation; reduce production costs, as the same matrix can be used countless times without significant loss of microbial activity. It ensures cell-cell communication and facilitates the control of cell growth monitoring.

Methods

The cultivation of multiple layers of 3D cells is possible by the development of porous and non-toxic matrices that provide good resistance, adhesion and greater contact surface. Collagen, polyurethane sponge, poloxamer hydrogel, porcine extracellular matrix, polycarbonate membrane, cellulose, cellulose matrices on top of hydrogel, hyaluronic acid and collagen scaffold has been developed as 3D matrices to grow microorganism. The isolation and immobilization of bacteria's on synthesised PVA biodegradable foams. The microbial assays tested on pot trials.

Results

Highly Porous, Biodegradable PVA foams were synthesized using chemical based foaming. Physicochemical, Mechanical characterization is being conducted for PVA foams. Morphological characterization to be conducted. By initial characterization, it was characterized to be highly suitable for immobilization of microbes. Formation of highly porous PVA with characteristics

suitable for microorganisms to exist. The morphological, physicochemical, thermal and mechanical characterization is to be conducted to determine its basic properties. The morphological properties, swelling and degradation behaviour in aqueous environment suggest that the PVA matrix has proper characteristics for microorganisms to exist. E. coli adheres to biomaterial and this immobilization preserves the proliferative capacity of bacteria and the metabolic activity after 24 hours but loses its capacity after 3 days. The metabolic activity preservation of the bio fertilizers might depend on the individual capacity.

Conclusions

The increasing impacts on the environment and the current agricultural practices in the affected the quality of the soil -alternative practices with improvement on the yield and economic benefits for producers and farmer. Bio fertilizers have varying effects in different environments. Immobilized bio fertilizers are key to overcome these limitations. Significant progress has been made in developing formulations of plant beneficial microorganisms by entrapment in water-soluble polymer-based carriers. PVA based bio fertilizer immobilization is the key for a sustainable future until we perfect the microbial based plastics and reduce the cost.

Keywords: PVA Foam, Bio fertilizer, Biodegradability

Soil Physical Health Index (Sphi) And Its Minimum Data Set (Mds) Indicators In North Bank Plain Zone Of Assam

Samikhya Bhuyan¹, Dilip Kumar Patgiri¹, Simanta Jyoti Medhi²

Department of soil Science, Assam Agricultural University¹, Jorhat 13,785013

Senior Software Engineer, Volvo group², India, ,560122

Purpose

The current study was carried out to established soil physical health index and identifies health indicators from in North Bank Plain Zone of Assam . A total of 180 no of geo-referenced surface (Upto 30 cm) soil samples were collected for analyzing soil physical health index.

Methods

The principal components analysis (PCA) was used to screened the minimum data Set (MDS) indicators for computing soil physical health index (SHI).

Results

The selected MDS indicators were clay, microaggregate, total porosity, volume expansion, permanent wilting point among 15 studied soil physical properties for computation of soil physical health Index (SPHI). Among these soil indicators, clay had highest contribution towards the SPHI (39.99%), followed by microaggregate (25.24 %) > total porosity (16.04%) > permanent wilting point (10.04%) > volume expansion (8.68%) & the calculated SPHI ranged from 0.49 to 0.93 with an average of 0.61. The multiple linear regression for calculation of soil physical health index (SPHI) was found to be $SPHI = C * -0.0071 + TP * 0.0447 + MIG * 0.00164 + VE * 0.0130 + PWP * 0.0088 - 1.092$

Conclusions

From the study it can be concluded that among the 15 studied soil physical indicators clay, microaggregate, total porosity, volume expansion and permanent wilting point were the most sensitive MDS indicators affecting soil physical health. The average soil physical health index (SPHI) was found to be 0.61.

Keywords: Soil physical health index (SPHI), Minimum data set (MDS), Geo-referenced

Phylogeny of Indian *Odontotermes* on the basis of 16S mitochondrial ribosomal gene**Amit Kumar¹, Asha Poonia¹, Radhika Sharma², Ramneek Kaur³, Monika Jangra¹, Sharda Kalra^{1*}**¹Faculty of Life Sciences, Chaudhary Bansi Lal University, Bhiwani²Department of Biology and Environmental Sciences, College of Basic Sciences, CSKHPKV, Palampur, India³Dev Samaj College for Women, Ferozepur, India**Abstract**

Termites of the genus *Odontotermes* are important decomposers and pests of Indian Subcontinent causing severe damage to crops, timber and trees. Present study involves phylogenetic analysis of six species of Indian *Odontotermes* based upon mitochondrial 16S gene using parsimony and maximum likelihood methods. High A+T base composition was observed in all species. Phylogenetic tree were obtained using maximum likelihood method. Results revealed close relationship among *Odontotermes* species.

Keywords: Mitochondrial ribosomal gene, *Odontotermes*, Phylogeny, Sequence analysis, Termitidae, 16S

Introduction

Termites have high ecological and economic importance for organic matter turnover especially in tropical and subtropical environment. Taxonomy and phylogenetics of the *Odontotermes* has been conducted on the African (Darlington *et al.*, 2008) and Malaysian taxa (Cheng *et al.*, 2011). But very fewer studies have been done on Indian *Odontotermes*.

The ecological importance of termites, together with their uniquely derived social structures and cooperative behavior, makes the accurate reconstruction of termite phylogeny an important goal. In present study, Mitochondrial ribosomal gene 12S was selected for molecular characterisation and phylogenetic studies of six species of Indian *Odontotermes*.

Material and Methods

Odontotermes sequences were obtained from gene bank nucleotide database making a search query for “*Odontotermes* 16S India”. A total of 258 results were obtained for the search query (Figure 1). The results consisting of *Odontotermes* mitochondrial 16S genes were selected manually and their sequences were copied in Fasta format from NCBI (Figure 2). The alignment was carried out of the slecetd sequences using Clastal W using MEGA 11 software (Tamura, 2021). The phylogenetic analysis was carried out using the maximum likelihood method. The results thus obtained were analysed.

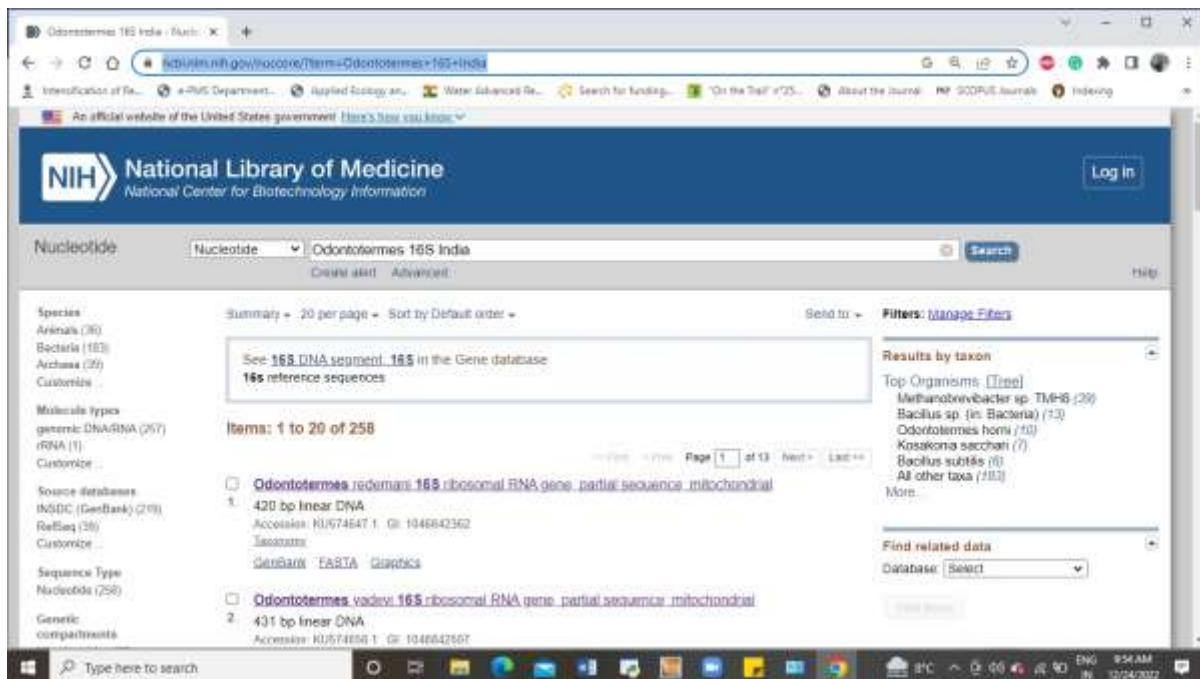


Figure 1. Results of search query for “*Odontotermes 16S India*” obtained from NCBI database

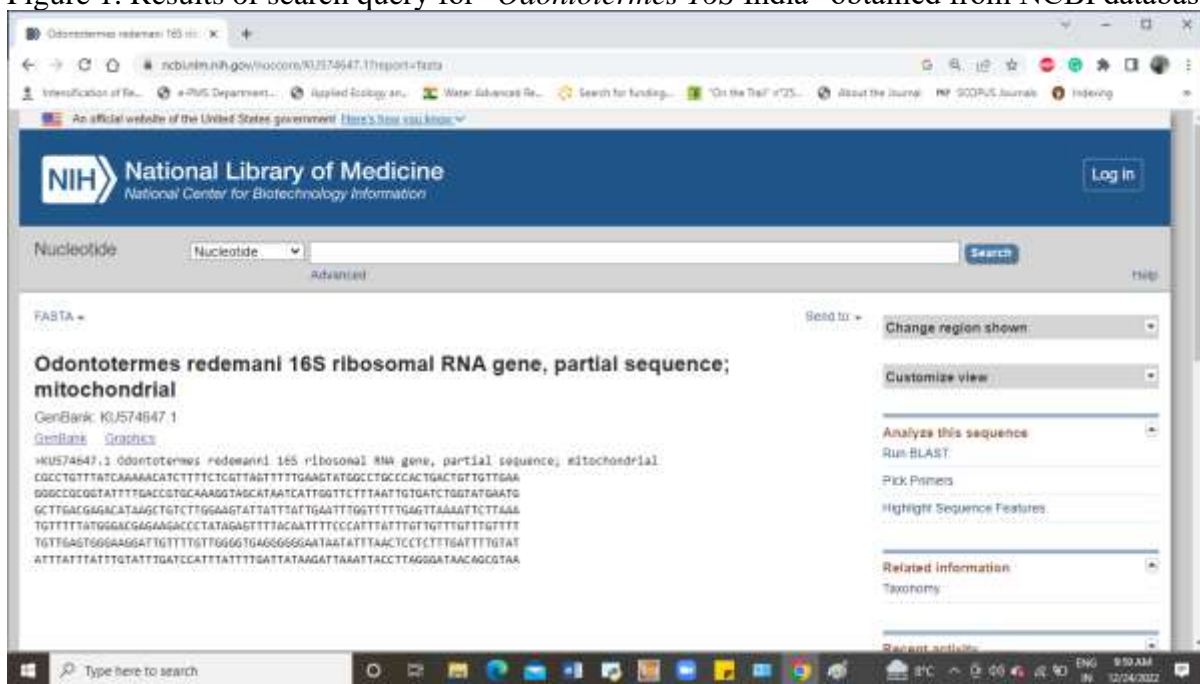


Figure 2. Download of FASTA sequence from NCBI database Results and Discussion

The data obtained from the selected 22 nucleotide sequences of Indian *Odontotermes* was analysed to study the phylogeny of Indian *Odontotermes* (Table 1).

S. No.	Identified Species	Accession Number

1	Odontotermes redemanni 1	KU574647.1
2	Odontotermes yadevi 1	KU574656.1
3	Odontotermes yadevi	KU574655.1
4	Odontotermes assmuthi 1	KU574651.1
5	Odontotermes bellahuniensis	KU574650.1
6	Odontotermes feae	KU574649.1
7	Odontotermes obesus 1	KU574648.1
8	Odontotermes horni	GQ422892.1
9	Odontotermes bhagwatii 1	EU258631.1
10	Odontotermes horni Var2	EU258630.1
11	Odontotermes horni isolateVar1	EU258629.1
12	Odontotermes obesus isolateVar2	EU258628.1
13	Odontotermes obesus isolateVar4	EU258627.1
14	Odontotermes horni isolateVar3	KU574646.1
15	Odontotermes horni	KU574646.1
16	Odontotermes redemanni 2	KF792983.1
17	Odontotermes brunneus	KF792982.1
18	Odontotermes bhagwatii 2	KF769559.1
19	Odontotermes parvidens	KF769558.1
20	Odontotermes obesus 2	KF769557.1
21	Odontotermes assmuthi 2	KF769556.1

Table 1. Details of *Odontotermes* sequences selected from NCBI database

Nucleotide analysis

The nucleotide analysis was carried out using Mega 11 software (Tamura et al., 2022). All the species showed a higher AT content as compared to GC content (Figure 3). The predominance of transitions over transversions was observed in the gene sequence data, AT type being more frequent.

p-distance

MEGA11 was used to calculate the p-distance based on sequence alignment. There were a total of 440 positions in the final dataset. p-distance was less amongst members of same genera and family.

Phylogenetic relationship

The tree with the highest log likelihood (-2320.32) is shown. Initial tree(s) for the heuristic search were obtained automatically by applying Neighbor-Joining and BioNJ algorithms to a matrix of pairwise distances estimated using the Tamura-Nei model, and then selecting the topology with superior log likelihood value. The results are shown in Figure 4.

Study confirmed use of combination of molecular and morphological approaches for accurate species identification and led to resolution to the complex problem of *Reticulitermes* systematic. The same can be helpful in Indian *Odontotermes* also where accurate species identification is a problem as nineteen different species of Indian *Odontotermes* have been observed only from one state of India i.e. Haryana as reported by Poonia (2019). It clearly depicts the utility of such genetic tool in establishing the overall structure of relationship and taxonomic positioning of the lesser known species.

Acknowledgement

Department of Zoology, Chaudhary Bansi Lal University, Bhiwani is acknowledged for necessary facilities.

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Assessing climate resilience potential of Indian mustard varieties under different microclimatic systems

**** Anjana Chauhan and Salil Tewari**

Department of Genetics and Plant breeding G.B. Pant University of agriculture and Technology, Pantnagar, Uttarakhand, Pin 263145

Purpose

In India, the principal oilseed crops are *Brassica* spp., Rapeseed-mustard, which provides edible oils, vegetables, animal feed, sauces, and industrial lubricants. Indian mustard was discovered to be vulnerable to change in carbon dioxide (CO₂) and temperature. Agroforestry is a land use strategy that offers the only way to achieve both climate change adaptation and mitigation goals at the same time. Climate change is a serious concern in current times. The impact of it can be clearly seen in rising earth's surface temperature, melting of glaciers, floods, draughts, and more importantly deposition of greenhouse gases in the troposphere. Thus a climate-smart approach is required to counter the impacts of changing climate. Better land management, climate-resistant varieties and accessible gene diversity are all components of climate-smart agriculture.

Methods

Ten mustard varieties were planted in completely randomized block design with three replications under three types of land use system i.e., open field, poplar based agroforestry system and eucalyptus based agroforestry system. The experiment was conducted for two *Rabi* season 2018-2019 and 2019-2020. To assess G×E interactions and phenotypic stability in Indian mustard varieties AMMI model was deployed. The observations recorded were days to flowering, days to maturity, plant height, Length of main raceme, Number of siliques in main raceme, No. of primary branches/plant, number of secondary branches/plant, Length of a silique, Number of seeds per silique, biological yield/plant, 1000-seed weight, harvest index, seed yield/plant and oil content. For estimating the carbon sequestration potential of different land use system soil organic carbon, tree carbon and crop plant carbon were calculated. For pre-fertilisation and pollen tube abnormalities interspecific crosses were made among six cultivated species of *Brassica*, during the *Rabi* season of 2018-2019.

Results

Based on AMMI I, AMMI II and ASV estimates, few varieties were registered stable across all studied environments with high mean performance for maximum number of traits like days to maturity, plant height, biological yield/plant, harvest index, seed yield/plant and oil content. Favourable environment for maximum number of traits were open field during crop season 2018-2019 and 2019-2020. Poplar based agroforestry system was favourable environment for late flowering, late maturity and biological yield/plant. Eucalyptus-based agroforestry system for both crop seasons recognized as most unfavourable environments for maximum traits. Pre-fertilization studies on interspecific crosses revealed several types of pollen tube abnormality like swelling of tip of pollen tube, coiling of the pollen tube, bursting of pollen-tube, more than one tube growing from the single pollen, bending of pollen tube and pollen tubes growing in opposite direction.

Conclusions

In this era of changing climate poplar-based agroforestry system can be utilised for late-maturing Indian mustard varieties. This may be considered as suitable land management option with excess CO₂ mitigation and increase in the soil organic carbon. A stable variety with the least G × E interaction and high ASV (AMMI Stability Value) can be used in different breeding programs for the development of climate robust varieties. Studies on pre-fertilisation barriers like pollen tube abnormalities among the crosses of *Brassica* species will decipher the knowledge on gene diversity and the possibility of transfer of valuable wild genes from one species to another species.

Keywords: Climate resilience, agroforestry, G × E, CO₂ mitigation, pre fertilization barrier

***Citrus indica*: A Journey from Herbal Medicines to Tea** **Upasana Deb, Sheena Haorongbam**

NEHU, Tura Campus

Purpose

Citrus indica, the progenitor of oranges, is found in the Garo Hills of Meghalaya and has been used by the locals for the treatment of various ailments. However, the fruit is seasonal and the fruit in general is rarely consumed due to its sourness. Therefore, an attempt has been made to introduce the fruit in the diet of people by value addition and making a blend of black tea with its dried peel, so that people can enjoy its goodness the whole year.

Methods

Standardization of the tea composition was done. For that, various ratios (50:50, 60:40, 70:30, 80:20, 90:10) of black tea and the fruit peel respectively was considered. One teaspoon of the tea composition was taken in a tea ball infuser and then dipped in a cup of boiling water for 2 minutes. The tea ball was removed. Sensory evaluation of the five teas were done by ten panellists using 9-point hedonic scale. Descriptive analysis of the tea was also done. The tea composition with maximum score was taken as the final product.

Results

The dried peels of *C.indica* had no aroma or taste. So, when the teas were tasted only the taste and aroma of black tea was felt. The flavours of tea increased with increased composition of tea leaves. Hence, the ratio with 90:10 composition of tea and peels respectively was preferred by the panellists.

Conclusions

The introduction of *C.indica* in tea could act as a nutraceutical as the goodness of *C.indica* will get incorporated into tea, without changing its flavours. However, further study on the composition of the final product needs to be done to see the amount of nutrition the tea carries.

Keywords: *C.indica*, black tea, blend, standardization, hedonic scale

Manisha Pandey* Prof. S.P Joshi & Sachin Sharma

Multipurpose Utility Of Wild Edible Plant Of Tehri Uttarakhand

Eco-Taxonomical Research Laboratory, Botany Department

D. A. V. (P. G.) College Dehradun, Uttarakhand, India. 248001.

[Hemvati Nandan Bahuguna Garhwal (A Central University) Srinagar, Garhwal, U.K. India]

Purpose

The aim of the study was to document multipurpose of wild edible plant in the study area.

Methods

The present study was conducted in 10 villages covering the Mussoorie Forest Division 2 Ranges, of Tehri Uttarakhand. The information was collected through structured questionnaires along with

field visit, group discussions and key informant interviews. The informants included mature seniors who were aware of their wealth in the forest, as well as middle-aged adults. Based on occupation, gender, and age the informants, who represented a wide range of persons, were divided into various categories. Total 593 informant in which 362 (61%) of the informants were male, and 231 (39%) were female. In compared to females, male participation was somewhat higher. According to this survey, 539 interviewees (91%) were farmers, while 54 (9%) were employed in government services.

Result

A total 66 species were reported in the study area. Ethno-botanical important species were classified into different use categories by local according to their use. Among use categories, trees were used for medicine, 44% edible, 18% fodder, 20% fuel timber 4% religious 3%, fibre 1% and miscellaneous 10% use in the area. The informant consensus factor (0.99) was found for timber followed by medicine (0.91), fodder (0.98) fuel (0.98) and Miscellaneous uses (0.92). These findings highlight the importance of tree resources in mountainous regions.

Conclusions

Wild edible plants can be a valuable source of nutrition and a way to connect with nature. However, its distribution is decreasing every day as a result of overharvesting, grazing, fodder and fuelwood collection, forest fires, careless tree cutting, illegal wild plant collection, and rapid spread of noxious weeds like *Eupatorium adenophorum* and *Parthenium hysterophorus* (Gajar Ghas) in various locations.

Keywords- Wild Edible, livelihood, resources, multipurpose, Conservation.

A contextual sentence about my motivation behind my topic.

I have been drawn to the study of wild edible plants as a method to better understand the natural world and discover how to live off the land in a more balanced and self-sufficient way since I have a strong interest in sustainable living and a desire to reconnect with nature.

A descriptive statement about the types of literature used in the review.

Gaur R.D., 1999. Flora of the District Garhwal North-West Himalaya (with ethnobotanical notes).

Summarize findings.

A total 66 species were reported in the study area. Among use categories, trees were used for medicine, 44% edible, 18% fodder, 20% fuel timber 4% religious 3%, fibre 1% and miscellaneous 10% use in the stud area.

Conclusions based upon findings.

To maintain their long-term viability and the preservation of the environments in which they flourish, wild edible plant conservation is essential. Important species can go extinct as a result of exploitation and habitat degradation, which can have a cascading effect on the environment and surrounding communities.

Lotus Petiole Fiber – a novel material for Technical textiles

Madhu Sharan & Sumi Haldar

¹*Department of Clothing and Textiles, Faculty of Family and Community Sciences
The Maharaja Sayajirao University of Baroda, Vadodara (Gujarat*

Purpose

Technical textiles is the promising sector which is rapidly growing around the globe. Technical textiles is defined as a functional fabrics that are used for the specific purpose in hospitals, automobiles, industry, space, agriculture and construction sites. As per the Ministry of Textiles report, the global contribution of technical textiles in western countries is 50 % whereas in India it is meagre that is 11 % which needs further improvement and that can be achieved by strategic planning and novel ideas in research. Based on the usage, there are 12 technical textiles segments – Oekotech, Medtech, Geotech, Mobiltech, Cloth tech, Home tech, Pack tech, Indutech, Protech, Sportstech, Buildtech and Packtech. Medical textiles focused on fiber based products intended for health care applications such as prevention, care and hygiene. Co-vid 19 pandemic has generated a higher demand for the medical textiles. Medical textile products are made in different structures like nonwoven, knitted and braided etc. Most nonwovens are made of oil based chemical fibers. With the increasing price of oil and market shift towards sustainable raw material there is huge demand of natural fibers made from agrowaste. Lotus (*Nelumbo Nucifera Gaertn*) is an aquatic perennial plant cultivated widely across the globe. Lotus plant has a huge medicinal properties like- Anti-hypertensive, antimicrobial, antioxidant, antiplatelet, antipyretic, aphrodisiac, cardiovascular, hepatoprotective, hypoglycemic, lipolytic activity, anti-diabetic, anti-inflammatory, anti-oxidant, immunomodulatory, hypocholesterolaemic, anti-amnesic, anti-depressant, anti-thrombotic, antiproliferative, anti-steroidogenic and memory –improving sedative activity. After picking the flower the entire petiole is left in the pond as a “waste”. These petioles contain the precious micro- fine fibers. The research majorly aims to utilize this petiole waste for the extraction of fibers, testing of fibers for its functional properties, developing a hygiene product and further testing the product for quality evaluation.

Methods

The study is experimental and exploratory in nature.

Procurement of petioles: Petiole is the part between flower and rhizome of the lotus plant. Waste petioles was collected from local lotus flower supplier Mr. Isabbhai Rathod from Vadodara district of Gujarat. The species was *Nelumbo Nucifera Gaertn.* that is pink lotus.

Extraction of fibers: Extraction of the fibers was done manually. As the manual extraction is time consuming and laborious. The researcher designed the apparatus for extracting the raw fibers from lotus petioles. For designing the machine the researcher take the assistance from robotic engineer Shreyash Patel from Vadodara district of Gujarat.

Testing of fibers: To confirm the application of lotus fibers in medical hygiene product following test were done: Absorbency is one the major factor for medical hygiene product. Water absorbency test like free absorbency test, equilibrium absorbency and absorbency under load (AUL) was done as per E691-14. pH value of the raw fibers was assessed as per IS 1390 (Cold Method). Free Swell Absorptative Index of the fiber was evaluated as per WSP 240.3 – 2011. Testing was done at Coe-Medical textiles lab of SITRA - South Indian textile research association at Coimbatore India.

Development of nonwoven sheet: 100 % lotus nonwoven fabric was developed in Textile production lab of Avinashillingam College of Home Science Coimbatore, India.

Testing of nonwoven fabric: Nonwoven fabric was tested for its physical properties like thickness and GSM. Lotus nonwoven sheet was subjected for antibacterial test as per AATCC 147 against two organisms *S.aureas* and *klebsiella pneumonia*. The test was performed at Microbiology lab of BITRA Bombay Textile Research Association.

Development of hygiene products: The 100 % Lotus nonwoven sheet was used in core layer of the sanitary napkins. The sanitary napkin was prepared in Incubation Lab of SITRA – South Indian Textile Research Association Coimbatore. Focusing on the properties of the nonwoven sheet many

other hygiene products like sweat pads and panty liners were also prepared. The developed sanitary napkin were tested for its essential test – Ability to withstand pressure after absorption as per IS 5405:2019 Annex B.

Results

It was observed that raw lotus fibers can be converted into 100 % nonwoven sheet. In the manual extraction method four to five petioles were taken together and fibers were laid over the felt. Due to the high cohesiveness of fibers it naturally form a web like structure. Hence the researcher further designed the machine consisting of one wooden plate with hooked nails and the roller in which lotus petioles will be placed with the revolution of roller further the fibers will be wined over this hooked nails. It was found that fibers extracted from this mechanism was very clean it doesnot any foreign impurities. From the testing results of raw lotus fibers it was found that fibers has an inbuilt antibacterial activity shown in Table-1. Free swell absorbency index of the lotus fiber was 35 percent which is more than Lyocell and Model fibers. It is very important test for hygiene products because it gives the idea that how much fluid fiber can hold. As the human undergo through the different activities like sitting, running and sleeping. Hence different types of absorbency test were performed like free absorbency test was done by the tea bag method. The free absorbency index of the fiber was about 50.85 % which is more than other natural cellulosic fibers, equilibrium absorbency was 34.39 % and absorbency under load and pressure was 16.01 % which is satisfactory for the application in absorbent core materials. As per the standard ISO: 5405 the pH value ranging between 6.8-8.5 ensures that they fulfill purpose without causing any irritation and discomfort to users. The pH value of the lotus fiber was found 7 which is very well accepted for the development of sanitary napkins. The 100 % nonwoven sheet developed has got a very less thickness (0.47 mm) and the GSM (2 ounces). Thus, weight of the nonwoven sheet falls under very light weight category which is very much helpful for preparing the essential hygiene product along with the functional property of the material The 100 % Lotus nonwoven sheet was used in core layer of the sanitary napkins. The sanitary napkin was prepared in Incubation Lab of SITRA – South Indian Textile Research Association Coimbatore. First the nonwoven sheet was cut according the standard size of sanitary napkin and layers were arranged and the sanitary napkin was stitched in the Ultrasonic machine. The upper layer was polypropylene spun lace sheet core layer which is the main, essential and functional part of the products that was made of 100 % lotus nonwoven sheet and the third layer was polyethylene sheet. The developed sanitary napkin were tested for its essential test – Ability to withstand pressure after absorption as per IS 5405:2019 Annex B. The developed sanitary napkin absorbed 30 ml of colored liquid within 6 minutes there was no leakage observed at bottom and sides of the sanitary napkin. The developed napkins were passed through the test. The main quality of the napkin is there is no addition of SAP in the core layer. Without super absorbent polymers it can absorb the fluid well. Focusing on the properties of the nonwoven sheet, many other hygiene products like sweat pads and panty liners were also prepared.

Table 1 : Antibacterial Assessment of Lotus Fibers.

Sample	Staphylococcus aureas.			Klebsiella pnemonia		
	Growth under specimen	Zone of inhibition	Zone of inhibition (in mm)	Growth under specimen	Zone of inhibition	Zone of inhibition (in mm)
Lotus Fiber						

(Nonwoven sample 25X50 mm)	Absent	Absent	Absent	Absent	Absent	Absent
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Fig1. Lotus Petiole Waste



Fig 2. Extracted Fibers



Fig. 3 Nonwoven Sheet

As compare to the commercial products the weight of the developed products are less they donot contain any SAP and it doesnot contain any antibacterial finish also. Raw lotus fibers in its initial processing stage are not been treated with any chemicals and not bleached also. Generally the fibers used in the core layer of the napkins undergo the bleaching process which whitens the fiber and also releases dioxin which is very harmful for the human health and environment.

Keywords: Technical , Textiles, Medical, Lotus, Petiole, Fiber.

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Material for Technical Textiles. www.technotex.gov.in, www.txcindia.gov.in

Comprehensive phenotyping of the SKUAST-K released rice varieties for root, shoot and physiological traits under drought stress**Sadiya Shafi¹, Aaqif Zaffar¹, Ishrat Riyaz¹, Sabiya Sayeed¹, Masooda Bashir¹, Bisma Jan, Sajad Majeed Zargar², Asif B. Shikari¹, N. R. Sofi³ and Parvaze A. Sofi¹**¹*Stress Physiology Lab, Division of Genetics & Plant Breeding, SKUAST-Kashmir, Wadura, 193201-India*²*Proteomics Lab., Division of Plant Biotechnology, SKUAST-Kashmir, Shalimar Campus 190025-India*³*Mountain Research Centre for Field Crops, SKUAST-Kashmir, Khudwani, 193201-India;***Purpose**

North Western Himalayan region is a hot spot of rice biodiversity and within this broad region, although, more than 100 rice landraces have been documented from Kashmir valley. The present work was the first comprehensive study on root traits and their relationship with shoot morphological and physiological traits under drought stress for the 10 varieties released by SKUAST-Kashmir for North Western Himalayan Kashmir region.

Methods

The experiment was conducted in greenhouse to using PVC columns with two plants in each column. Roots were harvested after 48 days and scanned using a Epson perfection scanner using Rhizovision Explorer software after proper calibration.

Results

Significant variability was observed for root and shoot traits among rice varieties released by SKUAST-Kashmir. Phenotypic range of major root traits was recorded at 63.3-93.67 cm (rooting depth), 2.52-9.69 g (root fresh weight), 0.51-1.59 g (root dry weight), 0.24-1.11 (root shoot ratio), 449.94-2409.56 cm (total root length), 0.25-2.38 mm (root diameter), 265.51-3321.09 cm (perimeter), 12.19-1989.28 cm³ (root volume), 110.82-3588.09 cm² (root surface area), and 0.06-0.31 cm/cm³ (root length density). Among shoot traits, a broad range was also recorded for all traits. In terms of the association between root and shoot traits, our results (Figure 4) indicated that shoot weight was significantly correlated with root shoot ratio ($r = 0.915$). Shoot length was significantly correlated with root dry weight, root diameter, and surface area ($r = 0.311$, 0.302 and 0.281 respectively). Similarly, the number of tillers was significantly correlated with root fresh weight, root diameter, root volume, and surface area ($r = 0.329$, 0.720 , 0.452 and 0.395 respectively). Among physiological traits, canopy temperature depression was significantly correlated with root depth and surface area ($r = 0.285$ and 0.309 respectively). The PCA grouped japonica type varieties (K-332, Kohsar and Shalimar Rice-5) together along with Chenab (indica type), as it had overall better root traits among all indica varieties, whereas all other indica varieties were grouped together.

Conclusion

It can be safely concluded that root traits significantly contribute towards better productivity and should be used in varietal development process.

Keywords: Rice, japonica, root architecture, canopy temperature depression

Biochar-based tillage systems have potential to enhance soil health and sustain rice-wheat system productivity**Tony Manoj Kumar Nandipamu^{1*}, Sumit Chaturvedi¹, V. C. Dhyani¹, Subhash Chandra¹, S.P. Pachauri², S.C. Shankhdhar³**¹Department of Agronomy, COA, GBPUA&T, Uttarakhand²Department of Soil Science & Agricultural Chemistry, COA, GBPUA&T, Uttarakhand³Department of Plant Physiology, CBS&H, GBPUA&T, Uttarakhand**Purpose**

Climate change is already having a substantial effect on natural resources, input availability, and crop output levels. Capturing atmospheric carbon and storing it in soil might help to minimise the effects of climate change. Biochar is a biomaterial with extraordinary features such as increased porosity, surface area, and adsorption sites that address climate change mitigation through soil C sequestration.

Methods

An experiment was carried out at NEB CRC, GBPUA&T, Uttarakhand, during the kharif and rabi seasons of 2021-22 in rice-wheat cropping system to tap into the potential of biochar in nutrient-use efficiency under varied tillage schemes. Three tillage schemes *viz.* Direct-Seeded Rice DSR *fb* zero tillage (ZT), Transplanted Rice with Biochar 5 t/ha (TR-B) *fb* ZT and TR *fb* conventional tillage (CT) in main plot and 5 nitrogen management practices *viz.* 100% Recommended Dose of Nitrogen (RDN) (NPK 12-32-16), 100% RDN (120-60-40 N-P₂O₅-K₂O/ha) Biochar Coated Urea (BCU), BCU 75% RDN, BCU 50% RDN with 2 sprays of Nano-urea, and a Nitrogen control in sub-plots, were replicated thrice under split-plot design.

Results

The grain yield among the tillage systems was found 2.64–10.9% more under DSR, where 3.47–12.6% more under ZT, respectively, compared to TR-ZT and TR-CT systems. The soil total organic carbon (TOC) was improved by 17.1–59.7% when biochar was applied under TR-B compared to ZT+R and CT systems. But the soil microbial biomass carbon (SMBC) was found 43.2–85.7% with deployment of rice-wheat cropping system under ZT+R compared to TR-B *fb* ZT and TR *fb* CT treatments. Similarly, among the nitrogen management practices, BCU has 11.4–27.9% more nutrient use efficiency compared to other nutrient management practices.

Conclusions

Adoption of climate smart practises, such as conservation tillage and biochar with controlled-release fertilisers, serves the objective of increased productivity and sustainable crop production while reducing negative impact of environment on agriculture and maintains soil health to sustain crop production.

Keywords: Biochar, climate change, tillage, nitrogen management, zero tillage, residue, organic carbon

The Low-Cost Rain Water Harvesting Technology (Jalkund) for Enhancement of Productivity of Different Crops in Mid-Hills of Arunachal Pradesh**R.A. Alone*, Doni Jini, Thejangulie Angami, Ampee Tasung, and L.K. Baishya***ICAR Research Complex for NEH region, Arunachal Pradesh centre, Basar 791 101***Purpose:**

Unavailability of adequate amount of water during the dry season is a serious problem for successful farming in high rainfall areas like Arunachal Pradesh. Direct rainfall collection through water catch ponds/pits (Jalkund) can be highly beneficial to farmers for providing irrigation to crops during moisture scarcity conditions during dry seasons. The *Jalkund* using Low Density Polyethylene (LDPE) of 250- or 500-micron films revolutionize the concept in water management which dramatically restricts the seepage losses at a reasonable cost. Jalkund is found suitable for the farmers residing in the hill top for small scale agricultural activities. The study was carried out in 5 districts of Arunachal Pradesh *viz.* Leparada, Anjaw, Namsai, Longding and West Kameng involving 53 farmers in order to study the impact of low-cost water harvesting technology (using jalkund) on production and productivity of different crops cultivated by local tribal farmers.

Methods:

These farmers were given a Jalkund under NICRA, NEC and TSP projects. The data on production and productivity of different crops *viz.* Pea, soyabean, potato, tapioca, chilli, pineapple, ginger, banana, papaya, orange, maize, pulses, millets, tomato and cabbage was recorded before and after installation and use of Jalkund.

Results:

The percent increase in yield after use of Jalkund ranged from 26 to 83% among the crops. Highest response was noticed in cabbage (83%) followed by tomato (80%) and millets (48%). The percent increase in productivity (q/ha) after use of Jalkund was recorded highest in pulses (43%) followed by vegetables (40%) and cereals (40%). The average income from one unit of Jalkund is recorded Rs. 29525/- per year.

Conclusion:

The study concluded that there is significant increase in both production and productivity of all crops involved due to use of Jalkund.

Keywords: Jalkund, production, productivity

Implementing Telematics System Design For Traffic Voilations & Challans On Vehicles**Mr.Shrikant Joshi ,Nilesh Awate' Rupesh Shelke***Department of Mechanical Engineering, G. H. Raisoni College of Engineering Nagpur, 440016, India.***Abstract**

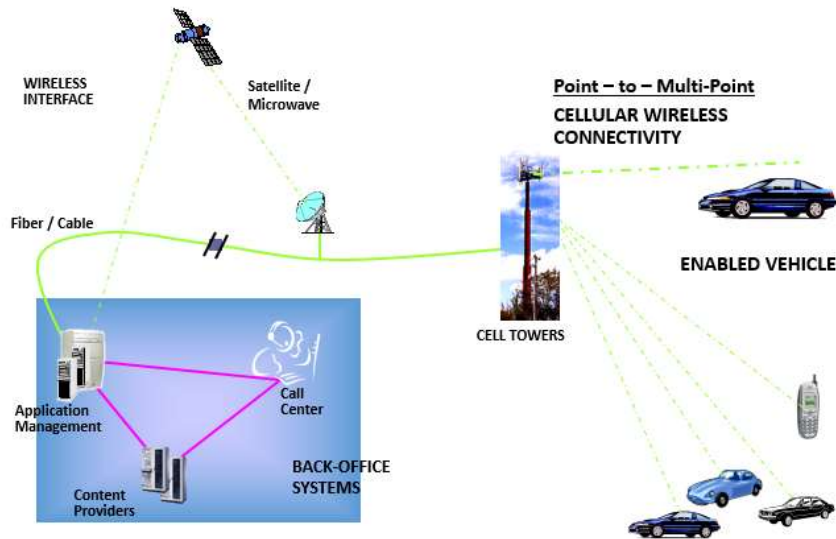
This research establishes a methodology for creating Telematics Design and Implementing interface connectivity between vehicle & Human with digital Platform. There are advanced methodology using CAD/CAM Software system, while also considering theoretical framework for experimentation concentrated upon calculation of parameters. Telematics is a method of monitoring cars, trucks, equipment and other assets by using GPS technology and on-board diagnostics (OBD) to plot the asset's movements on a computerized map. It's a two-way connection to and from a vehicle for data and information transfer from a vehicle. Nowadays each vehicle is fitted with Telematics device.

Keywords: Telematics; vehicle; GPS technology; cars; Trucks; experimentation.

Introduction about Telematics

In its broadest sense, telematics is the joining of two sciences—telecommunications, a branch of technology including phone lines and cables, and informatics such as computer systems. Today, the term is commonly used in reference to the telematics solutions utilized in commercial fleet vehicles. According to Gartner, wireless telematics devices and “black box” technologies collect

and transmit data on vehicle use,



maintenance requirements and automotive servicing. A popular option for modern companies is to utilize fleet management software, which is a branch of telematics, to coordinate the vehicles they manage and gain a comprehensive view of the health, profitability and productivity of their entire fleet.

Wireless use is growing more nowadays. India wireless industry in Coming years is growing very fast compare to other countries. Its population size will change India on a Global platform in coming years. 30 M India households will employ data networks by end of 2030. All territory sector is dependent on this Wireless technology. Intel’s Otellini predicts that 1.5 B PC’s will have wired or wireless broadband connections by 2030. Cable broadband services posting operating profits of ~60%. Consumers want to be more productive. Consumers pay Rs. 3000/mth for cell phones & internet service providers. An Average Indian citizen spends 541 hrs/yr driving in vehicles (1.5 hrs/day) (NTPS). 97 M people in the India spend at least 37 minutes commuting in their cell every day. Also automotive industry is highly competitive; features and services which provide a lead are crucial to success. A telematics system consists Vehicle (cell phone, GPS, vehicle data) It’s a Wireless interface which provides support to Back-office systems.

Structure

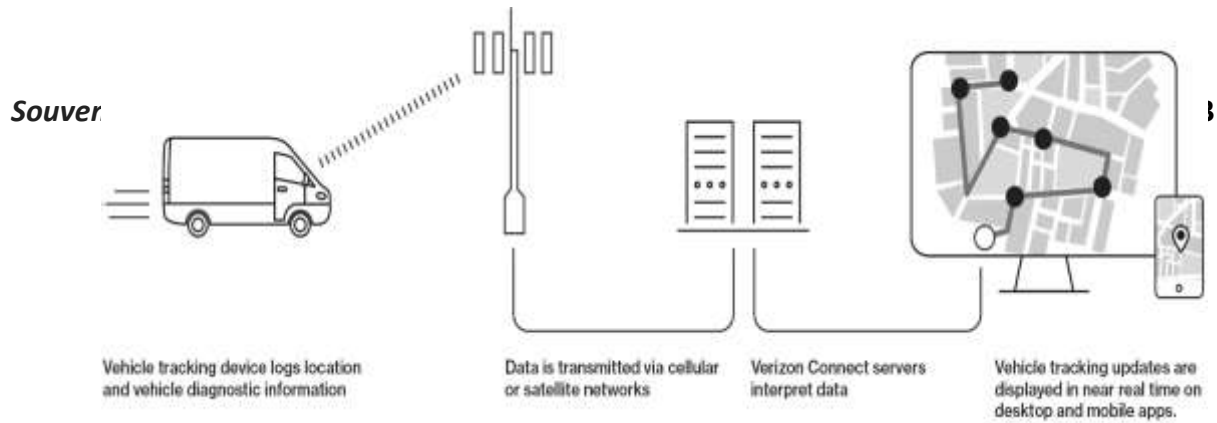


Fig 1.2 - Potential Components in a Telematics System

- A Wireless technologies that can be applied to telematics:
- Cell (Analog, CDMA, GSM; voice, data/SMS)
 - Short-range communications (Bluetooth)
 - Medium-range communications (802.11)
 - Satellite communications (Boeing Thuraya, XM Radio, Sirius)

There is a Market for Telematics for Automobile Industry for all the sub

- categories.
- Marine
- Roadways
- Airways



Fig 1.3 – WABCO TELEMATICS DEVICE

Fig 1.4 – Telematics Workflow Process

5. Telematics Work:

At its core, a telematics system includes a vehicle tracking device installed in a vehicle that allows the sending, receiving and storing of telemetry data. It connects via the vehicle's own onboard diagnostics (OBDII) or CAN-BUS port with a SIM card, and an onboard modem enables communication through a wireless network. The device collects GPS data as well as an array of other vehicle-specific data and transmits it via GPRS (General Packet Radio Service), 4G mobile data and cellular network or satellite communication to a centralized server. The server interprets the data and enables it to be displayed for end users via secure websites and apps optimized for smartphones and tablets. The telematics data captured can include location, speed, idling time, harsh acceleration or braking, fuel consumption, vehicle faults, and more. When analyzed for particular events and patterns, this information can provide in-depth insights across an entire fleet. Telematics devices are fitted on Personal vehicles: Cars, Trucks, Boats, Motorcycles, Aero Industries. Work vehicles: Mail trucks, semis, Border Patrol, Coast Guard, ambulances etc. Vehicle owners use this Technologies for Personal, Fleets, Military purposes. To consumers it provides various features for Safety & security. Its time savings (navigation) and increases productivity (in vehicle). For Fleet provider it Optimizes their assets (asset tracking, performance monitoring). To business models Additional data from vehicles (warranty, usage) is being taken out. It Increases vehicle sales (or "price of survival"). Current Telematics Services to Consumers provides Safety for their vehicles. Air Bag Deployment Notification, Seat Belt Tension Notification, Emergency Assistance, Roadside Assistance. Security features provides Automatic Theft Notification, Theft Tracking, GeoFencing, Vehicle Status & Remote Diagnostics support. Additional Telematics Services – Fleets provides Fleet Performance that helps in Maintenance Management of Fleet Tracking, Asset Management, Vehicle Information, Usage Monitoring, and Vehicle Tracking. Fleet Utilization of Customer Processing Paperless Manifest User log book Instant Messaging and Job Dispatching. There are many Opportunities for future for Data services, Software downloads, Content downloads, Enhanced vehicle diagnosis & for repairs. Expansion into other dimensions of vehicle lifecycle (manufacturing, vehicle development, design) will help Key enablers for future services/growth. Communications bandwidth Coverage (wireless) Vehicle penetration, Vehicle integration (messaging). Its Reduced costs (hardware, service) and its Standards (Bluetooth, vehicle messaging) will be very much useful.

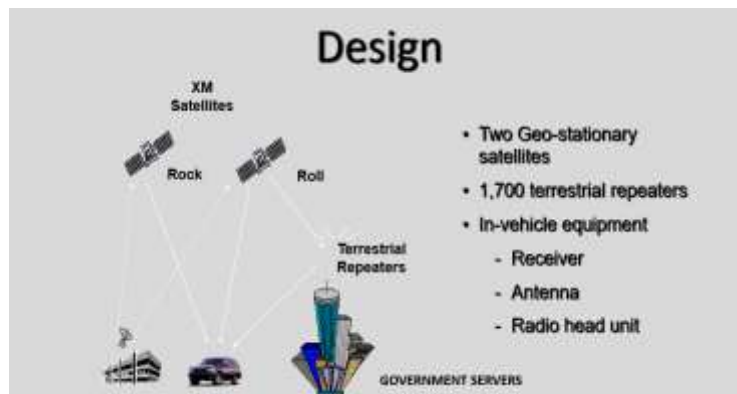


Fig 5.1 - Conceptual design of the proposed work

6. Telematics Device Installation

Many modern commercial vehicle manufacturers install embedded GPS tracking and telematics technologies directly in their fleet vehicles. If a vehicle does not come with this technology pre-installed, aftermarket GPS devices are available for installation. These can be battery powered or powered via the vehicle's own internal electrical system. Some OEMs, including Volvo, Mack, Ford, and GM, also partner with telematics providers to provide a seamless end user experience. In the coming years, it's likely that the automotive industry will continue to develop smart cars that use telematics to deliver better results for their customers. These systems will also capitalize on the emerging Internet of Things (IoT) landscape that can help connect vehicles to cities and smart traffic technologies.

7. Uses of Telematics in Fleets

Telematics solutions can integrate with existing applications and systems to enable an array of use cases for fleets of all sizes, including:

7.1 Vehicle tracking: Vehicles can be tracked using a combination of GPS satellites and receivers, GPRS networks and cloud computing. A GPS receiver downloads information from GPS satellites and processes it for use with applications such as driver [GPS navigation systems](#). It also transmits that information via GPRS to the web servers used by office-based staff, where it can be used to dispatch the nearest driver to a new job.

7.2 Trailer and asset tracking: Fleets can attach GPS trackers to trailers and other non-motorized [assets](#) to ensure they don't go missing, as well as use them to route drivers directly to stationary trailers. Drivers can tag locations in their GPS unit when unhitching a trailer, and those coordinates can be easily passed on, allowing them to route directly to the trailer. The system can also be set up so that an instant alert is sent to a manager's mobile device should a trailer or asset be moved without authorization.

7.3 Maintenance improvements: Vehicle maintenance and asset lifecycle management can be improved by using fleet telematics to track hours-of-use records and schedule preventative maintenance, as well as help keep tabs on warranty recovery, engine hour tracking and service records tracking. Fleet managers can decrease expenses and keep vehicles in safe operating condition by staying on top of engine diagnostics, including battery voltage, coolant temperature, powertrain malfunctions, intake valve issues, oxygen sensor problems, and more.

7.4 Safety tracking: Managers can use fleet telematics to monitor vehicle speed and location, as well as harsh driving events and seat belt use. Telematics provides a digital blueprint of every aspect of a vehicle's operation, helping fleet managers understand where improvements can be made in accident prevention measures and driver safety standards.

Insurance risk assessment: Insurance companies can use telematics to monitor driver behavior, allowing them to more accurately determine risk factors and adjust insurance premiums accordingly. Telematics devices can also report when a vehicle is used in a location outside a designated area, known as a geofence.

8. Benefits of Telematics in Fleet Management

Telematics technology can help fleets achieve operational improvements in key areas:

8.1 Decreased fuel costs: Telematics can help identify areas of waste, such as vehicle idling or fuel slippage, and allow fleet managers to address them promptly, which positively impacts fuel efficiency and the bottom line. It also can help management plan the most efficient route for each driver to reduce unnecessary mileage

8.2 Improved safety: Continuous feedback regarding driving style and [driving behavior](#) lets fleet managers coach drivers and reduce unwanted driving habits such as speeding or harsh braking. Improvements can be made based on actionable, data-based reports that highlight driver performance and support new safety targets.

8.3 Elevated productivity: With near real-time GPS system data, drivers can help avoid traffic delays and plan for inclement weather. Back office managers can quickly and easily attribute any new or additional site visits to the nearest vehicle and instruct them on the most efficient route to get there.

8.4 Better payroll management: By tracking the precise time a vehicle starts at the beginning of the day to the moment it shuts down, fleet managers have an accurate, automated record of how long an employee worked. This helps business owners verify that employees are paid accurately for the hours they work while eliminating unnecessary time spent manually matching up timesheets to job tickets.

9. Future of Telematics in India

Telematics is poised for exponential growth as new applications are developed to take advantage of modern GPS units and the widespread use of mobile devices. More fleets are recognizing the need to monitor fleet activity to control costs, boost productivity, improve accountability, and maintain full compliance with government regulations. As owners look beyond the basic needs in order to achieve "increasing integrations into the broader scope of the enterprise, including with mobile workforce management, ERP software, and business management software," telematics will become an integral component of all modern fleet operations.

10. Implementing Telematics Technology on NHAI & Government Servers:

Its Improved infrastructure management (traffic, tolls) and monitorance of vehicles on Government servers through Telematics System Design will be very much effective. Penalties, Challans and Fines can be applied for Traffic Voilations.

Government may launch Projects for future based on Telematics which will help for strict adherence of CMVR Rules across in India.

Below are the Criteria's in which Telematics Technology will be very useful for Government Authorities.

10.1 Speed Control 80km/hr – A fine can be imposed if vehicle speed is not maintained upto 80km/hrs on NHAI.

10.2 PUC Criteria – With the help of Telematics System Design PUC Readings of vehicle can be gathered and if the levels are not in range fine and Challans can be imposed.

10.3 Crash Alert System and Road Assistance Program on NHAI – If vehicle met with an accident at a particular location. The Government Authorities will track and trace the location. Automotically nearby call will be triggeres to Hospitals and support will be provided on spot itself. Road side support Taxes can be collected as per Vehicle Movements in across India.

10.4 Over Weight Tax Penalties – Over Weight Penalties can be collected if vehicles are running with heavy tonnage capacity on NHAI. The Working of this type wil be based on vehicle having

Load Capacities Sensors. Its data will be collected in Telematics from which penalties and fines can be imposed.

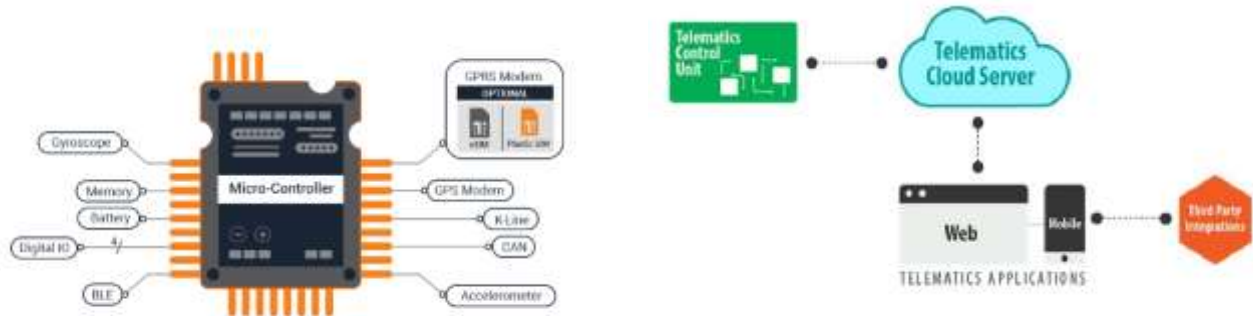
11. Telematics Data

A Vehicle telematics solution consists of the following 3 fundamental building blocks: Telematics Control Unit, The Telematics Cloud Server, The Front End- Web app and Mobile App.

The Telematics Control Unit (TCU), which is the central hardware module of the telematics device, has communication interfaces with the in-vehicle network (CAN Bus) and the back-end cloud server (GPRS).

TCU collects the crucial vehicle data such as diagnostics data, real time location, and speed of the vehicle (through different interfaces) and sends them to the cloud server over wireless network such as GPRS/cellular/LTE, in a specific packaged format.

This telematics data stored in the Cloud Telematics Server is accessed by the end-users through a web app or a mobile app.



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11.1 Telematics Control Unit (TCU): The Telematics Control Unit (TCU) is the central component of a telematics system managing numerous functions such as:

- Collecting vehicle data via CAN-BUS port
- Managing information collected over various communication interfaces such as CAN, GPS, UART, GUI etc.
- Memory and battery management
- Managing two way communication with the Telematics Cloud Server
- Managing the communication with the user dashboard/HMI device

Fig 11. 2 – Micro Controller Fig Controller Process

11. 3 – Micro

The telematics control unit (TCU) makes use of a set of hardware and software modules for efficient execution of these functions. Let us have a look at these hardware and software components in detail.

11.4 Basic framework of a TCU hardware architecture:

A Global Positioning System (GPS) module, for tracking the information associated with the latitude and longitude of the vehicle.

A Central Processing Unit, with memory management and data processing capabilities. Commercially available telematics systems are based on microcontrollers, microprocessors or even Field Programming Gate Array (FPGA) for managing multiple processes occurring within the TCU.

High performance processor from Telit Devices, Renesas Electronics, and ST Microelectronics are commonly used for developing efficient telematics system

11.5 CAN Bus module Communication and vehicle ECUs:

Many of the commercially available telematics devices also support OBD II, MOST, LIN interfaces. The TCU communicates with the vehicle ECUs through CAN bus and fetches crucial information such as engine performance, vehicle speed, data from the Tire Pressure measuring Sensors, etc. A telematics system may also use K/Line bus to alert the user about theft (by notifying the user if the vehicle is switched on by anyone), or to enable remote locking and unlocking of the vehicle.

A Memory unit, which is necessary for storing information during an unreliable or no network conditions; or in some cases, to store vehicle data for future use. This memory module is also useful for supporting advanced telematics functionalities like speech recognition. Flash and Dynamic random-access memory are some of the commonly used memory types in a vehicle telematics system.

Communication interfaces to support a wide range of communication including Wi-Fi, cellular, LTE etc.

A GPRS module for data connectivity and in some cases voice based communication with remote devices. Often the GPRS module comes with a sim card, e-sim card or plastic sim cards, in addition to the GPRS modem to enable communication with remote devices over the cellular network.

An in-built Battery module, with voltage rating of 3.2 to 3.4 volts, for integrated power management. The battery system is useful in a range of scenarios like :

As a cost-effective backup source for Real-Time Clocks when the vehicle engine is off

For Accessing telematics data ,for tracking and recovering stolen vehicle, when vehicle is switched off

Bluetooth Module, to connect nearby devices with the telematics device, for interfacing with the end-user's mobile phone for hands-free calls, text messages etc.

Microphone with Audio interface to enable features such as hands-free calls, voice based commands. It also supports stereo based output to play media files from the vehicle audio system.

A General Purpose Input/output interface (GPIO) system to connect lights, buttons. This includes both analogy and digital I/O type interfaces.

The HMI/user interface device to showcase crucial information such as navigation maps, vehicle speed, fuel usage etc. The user can use the HMI to access features such as hands-free calls on the move, view map, playing media files etc. The HMI is connected to the TCU through a GUI or HDMI port.

12. Conclusion:

Currently Telematics System is only used for tracking of vehicles and for Navigation Purposes only. But, it can be a Game Changer for Government in coming future. All the defined Criteria's above are presently nowhere in Across Globe. In India this type of feature can be implemented which will play a role model to other countries and there will be a strong improvement of Transportation with reduced risk of Accidents and Incidences. Implementation of Telematics System Design will improve the governance of Transportation. Its feature of Speed Control alert, PUC Criteria & over Weight Alerts will help Government to collect Taxes and Penalties from Public without any Corruption Factor. Moreover, the Technology is changing tremendously day by day and in Telematics the future of ADAS System (Advanced Driver Assistance System), DSMS – (Driver State Monitoring System) & Rador System will be developed in Automobile Segment which will more enhance the Transportation platforms and other networks stability with the Governments.

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Climate Change Sensitivity Assessment Of Rainfed Cropland Hement Kumar, Smita Chaudhry

Institute of Environmental Studies, Kurukshetra University Kurukshetra

Purpose

One of the world's greatest threats in the twenty-first century is climate change. An increasing amount of evidence (IPCC, 2001) supports the hypothesis that human activity, most notably the increase in anthropogenic greenhouse gas (GHG) concentrations, is responsible for the observed warming over the last several decades. Rainfed agriculture is particularly vulnerable to the effects of climate change due to its dependence on the monsoon and the potential of growing weather extremes as a result of the south west monsoon's unexpected activities in India. The goal of this study is to assess sensitivity of rainfed cropland production in present scenario.

Methods

The MODIS Land Cover Type Product (MCD12Q1) was used for extraction of cropland for Haryana state using ArcGIS software. The MODIS 17A NPP data products are available at 500m resolution which was downloaded as HDF file from NASA DAAC site for the year 2004-2020. Climatic variables of 17 years (2004-2020) observations for Maximum Temperature (Tmax, °C) and Precipitation (Pre, mm) were obtained from the Climatic Research Unit (CRU).R software was used to do a sensitivity analysis on cropland based on yearly NPP.

Results

Cropland productivity sensitivity was categorised into five categories based on the analysis (Very Low, Low, Moderate, High, and Very High). The study area's very low and low sensitive zones were the greatest, whereas high and very high sensitive zones were modest and mostly concentrated in the north. The highly sensitive zone accounts for 7.69% of the total area (1428.179 km²). According to rank study, the Fatehabad district is particularly sensitive, followed by Sirsa, Hissar, Bhiwani, Charkhi Dadri, and so on. The Fatehabad and Sirsa districts had the greatest average maximum temperature and the lowest average rainfall from 2004 to 2020.

Conclusions

NPP was utilised in this study to measure cropland sensitivity in rainfed areas, and the results showed that very high sensitive zones have a substantial link with maximum temperature and precipitation.

Keywords: Climate Change, NPP, Rainfed Agriculture, Sensitivity Analysis

Incorporation Of Rice Straw For Enhancing Potassium Content In Lateritic Soils: Mitigation Of Global Warming Against Crop Residue Burning

P. Sreelakshmi ^{2*} and Durga Devi K. M. ¹

Department of Soil Science and Agril. Chemistry Kerala Agricultural University, Thrissur, India, 680656

Abstract

Potassium has long been accepted as a versatile major nutrient that is essential for normal growth and development in plants and animals and is also been considered as “quality nutrient” because of its multifunctional role in metabolism of plant. But clay minerals (mainly Kaolinite) present in the lateritic soils of Kerala are of lower activity and do not permit the retention of available forms of potassium in the absence of any external K source. At the same time K (potassium) bearing minerals are also absence and farmers do not prefer the use of potassic fertilisers because of its un-subsidised huge cost. Several studies have stated that K from crop residues can substitute for a

portion of K fertilizers to fulfill crop requirements, reduce fertilizers expenses and enhance soil and crop benefits. So in place of K fertilizers, organic K sources such as cereal straw, plantain waste, wood ash, compost etc., are gaining more demand. Potassium ion solubilizes easily from plant residue materials into the soil solution due to its high mobility as a predominantly unbounded monoatomic cation in plant tissues. Various studies have reported that application of rice straw, (which contain about 1.2 to 1.5 per cent of K) could improve soil available K to a greater extent than manure. Therefore, use of such organic K resources such as rice straw can be considered as a best alternative for reducing the use of potassic fertilisers rather than burning these residues that result in release of GHGs and ultimately cause global warming and climate change. So, the present study consisted of decomposition dynamics of rice straw and its extend of K release in soil.

METHOD

STUDY OF DECOMPOSITION DYNAMICS AND POTASSIUM RELEASE RATE OF RICE STRAW

Rice straw was collected from lateritic soils of Thrissur district, Kerala after the harvest of second crop. The sample was air dried and cut into small fine pieces (1-2cm) and its physico-chemical properties were analysed by standard procedures. Bulk soil samples (0-15cm) were collected from Instructional Farm, College of Agriculture, Vellanikara at three different locations. Three polythene boxes of size 25 cm×15 cm×10 cm were taken and 3 kg of these collected soil samples were packed on each boxes. Ten grams of dried pieces of straw were tied in a nylon bag of size 10cm×5cm and packed in each box. Water was sprayed in each boxes to prevent complete drying of soil. Nylon bags were removed from the boxes at different intervals viz. 7, 14, 30, 60 and 90 days after incubation. On each sampling date, one nylon bag was randomly removed from each box and mud particles were removed that were adhered to the bag. Fresh weight and dry weight of rice straw bags, before and after decomposition were recorded to determine the decomposition amount which is calculated as per formula:

Decomposition amount (g) = (dry matter at 0 day – remaining dry matter at nth day) where n is the day of incubation

Decomposition rate (%) = (decomposition amount / dry matter at 0 day) ×100

The potassium release rate from each bag was also calculated at respective intervals using flame photometer as:

K release amount (mg) = K amount at 0 day – K remaining at nth day, where n is the day of incubation

K release rate (%) = (K release amount / K amount at 0 day) ×100

RESULTS

DECOMPOSITION RATE OF RICE STRAW

Rice straw had slightly acidic pH of 5.8 with electrical conductivity of 0.019 dSm⁻¹ and moisture content of 10.00 per cent and registered higher potassium content than nitrogen and phosphorous. From the incubation experiment, amount and rate of decomposition of rice straw was determined at different intervals viz., 7, 14, 30, 60 and 90 days after incubation. The results showed an increasing trend in decomposition of rice straw from each bag over the different time intervals selected for the study. Maximum decomposition was attained in 90 days of incubation (51.90 %), followed by 60 days (40.26 %), 30 days (34.63 %), 14 days (21.26 %) and 7 days (17.80 %) of incubation.

EXTENT OF POTASSIUM RELEASE FROM RICE

An increasing trend of K release was observed over the time intervals of decomposition. Among the different incubation intervals, maximum quantity of K release was observed at 90 days (84.28

%) after incubation of rice straw. Among these incubation periods, the highest increase in rate of K release was noticed from 7 to 14 days of decomposition.

Conclusion

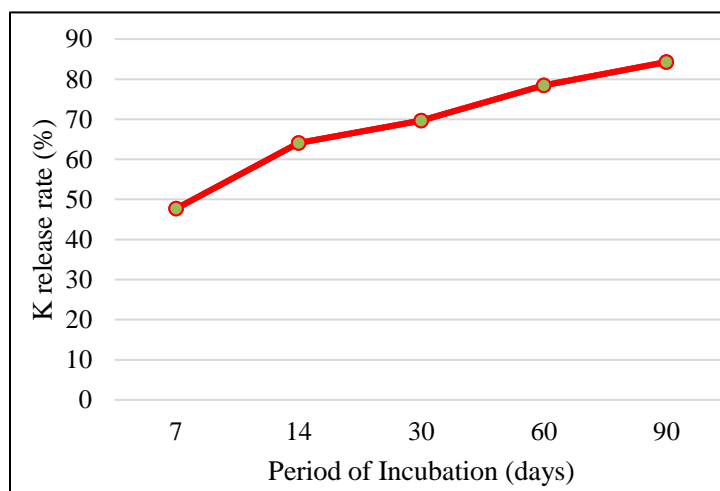
The rate of decomposition of rice straw depends upon the method of incorporation, length of the chopped straw, litter quality, material composition, structure and external factors such as moisture content and amount of carbon dioxide present in the soil. In the present study, the decomposition rate accounted for about 51.9% of the total mass of rice straw after 90 days of incubation period. This results depicts that decomposition rate of rice straw consist of two phases (i) rapid decomposition period and (ii) slow decomposition period. The easily decomposable materials such as lipids, carbohydrates and starch which account for less than 25% of the straw get quickly decomposed. But rice straw mainly consists of slowly decomposable materials like cellulose (38%) hemicellulose (25%) and lignin (15%)), that takes more time for breakdown into simple substances (Nguuyen *et al.*, 2019). As the decomposition rate increased, the K release rate has also increased that resulted in increase in the availability of potassium in the soil. Because, K ions are highly mobile in plant tissue that showed their rapid release from the straw. The reason might be due to highest content of potassium than nitrogen and phosphorous and most of the K ions are in water soluble form that are easily mobile. Therefore, incorporation of rice straw as surface or subsurface mulch is considered as an effective method for ensuring long term availability of potassium in soil due to their slow rate of decomposition. It is the best alternative against continuous burning of leftover straws after harvest that release sufficient quantities of GHGs like methane, carbon dioxide etc. So, this method can be considered as a mitigation measure against global warming and climate change.

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ILLUSTRATION

Fig. 1. Rate of potassium release from rice straw at different incubation intervals



Avian diversity of public garden: valley of wild flowersishwariya hill garden, madhapar, rajkot, gujarat, india**Devanshkumar S. Makwana and A. P. Goswami**^{1,2} *Department of Biology, M. V. M. Science & Home Science College, Saurashtra University, Rajkot360005, Gujarat, India***Purpose**

The present ecological study plays a significant role in the conservation of avifaunal diversity. The present work dealt with species community and diversity pattern of birds at Valley of wild flowers, Ishwariya hill garden, Madhapar, Rajkot, Gujarat, India; during July 2021 to June 2022 (12-Months). We aim to prepared checklist and see the avian diversity of selected site.

Methods

On the basis of preliminary surveys of study area during July (2021) to September (2021) methodology established and map created. Data records of birds were sighted at random under total 27-visits; by approaching each macro and micro-habitat and peripheral boundaries by walk. Random sampling method, Point count method and Line transect method these 3- methods are used for collecting data.

Results

A total 109 species of birds, belonging to 86 genera of 42 families and 14 orders were recorded from study area during these 9-months (October-2021 to June-2022). Family wise highest species diversity (9) in (Anatidae and Scolopacidae) was observed in each family, highest genus (6) in (Scolopacidae and Muscicapidae) in each family and highest bird's population (1932, individual) were observed in birds belonging to Pelecanidae. The numbers of terrestrial bird species (59) were higher than aquatic birds (50); as population were high in aquatic birds (6339) then terrestrial birds (4136) and total individuals are 10475.

Conclusions

On the basis of this good results and diverse avifauna we conclude that this area provides good resources, good environment to the avifauna.

Keywords: Avian, diversity, valley of wild-flowers, checklist, familial number

Nanotechnology-Driven Precision Nutrient Management For Enhancing Plant Nutrition And Soil Physico-Chemical Properties**Barenya Gogoi, Raihana Habib Kanth, Amal Saxena, Tauseef Ahmed Bhat, Inayat Mustafa Khan, Bisma Jan***Faculty of Agriculture, Wadura, SKUAST-K, Jammu and Kashmir, 193201, India***Introduction**

As a basic tenet to sustainable agriculture, there is dire need to minimize the use of agrochemicals that can protect the environment from degrading. One of the world's leading crops serving as food and fodder is maize. As nitrogen is an important ingredient for maximizing maize production, it is crucial to manage nitrogen to fit the crop's needs. Generally urea is prevalent as the primary source of nitrogen. With an annual use of 33.6 million tonnes in 2019-20, urea accounts for 82 % of the total consumption of nitrogenous fertilizers in India (FAO, 2020). The recovery of applied N by maize rarely exceeds 50 %. When prilled urea is applied as basal dose, nitrogen suffers losses due to various pathways such as leaching, runoff, ammonia volatilization, additional gaseous N losses and immobilization. As a consequence, applied fertilizer may not be able to reach the targeted sites in the plant system and unable to enhance optimal growth and productivity of the maize. Hence,

an attempt is made through precision agriculture to increase the efficacy of applied fertilizer in the form of nano-urea.

Objectives:

To study the impact of nano-urea on soil physico-chemical properties.

To study the impact of nano-urea on nutrient uptake on grain and stover of maize.

Methodology:

The present experiment was carried out during kharif season of 2022 at Agronomy Research Farm, Faculty of Agriculture, Wadura, Sopore, SKUAST-K. The variety of maize used was SMH-5 under irrigated condition. The experiment had 10 treatments including control, recommended dose of nitrogen (RDN) and remaining 8 treatments with 4 doses (2 ml L^{-1} , 4 ml L^{-1} , 6 ml L^{-1} , 8 ml L^{-1}) of nano-urea, each with 1 spray (30 DAS) and 2 sprays (30 & 60 DAS) respectively. All the treatments were replicated thrice. Data collected on different characters during investigation were analyzed by the analysis of variance (ANOVA) technique for randomized complete block design (RCBD) using OPSTAT software.

Results:

1. The results revealed that the treatment with 75% RDN (prilled urea as basal dose) and 4 ml L^{-1} nano-urea sprayed at 60 DAS recorded the highest soil available phosphorus (16.99 kg ha^{-1}) and potassium ($177.99 \text{ kg ha}^{-1}$) as compared to other treatments. This increase in availability of nutrients in soil may be caused by reduced application of prilled urea into soil, as a result the over-accumulation of salt in soil is minimized. Thus, reducing residual acidic effect and increasing the availability of nutrients to plants.

2. The treatment with 75% RDN (prilled urea as basal dose) and 4 ml L^{-1} nano-urea sprayed at 60 DAS led to highest N uptake in grain ($100.14 \text{ kg ha}^{-1}$) and stover (67.38 kg ha^{-1}) at 90 DAS as compared to other treatments. Compared to conventional urea, particles of nano-urea have increased surface area to volume ratio and improved nutrient absorption efficiency. The small size of the nanoparticles (1-100 nm) allow them to enter through the stomatal pores ($10 - 50 \mu\text{m}$) leading to better penetration and translocation of the nutrient in the plant, increasing the nutrient uptake in grain and stover.

Conclusion:

Application of nano-urea in maize through foliar spray as an alternative to the conventional practice of soil application of prilled urea was very effective in enhancing the soil physico-chemical properties as well as nutrient uptake in grain and stover. The effect of environmental toxicity as a result of excessive use of synthetic fertilizers could be better addressed by the intervention of such nanotechnological tools without compromising the soil quality as well as plant nutrition. Thus, aids as a sustainable option for farmers towards precision agriculture and helps in combating climate change as well.

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Influence of plant bio-regulators on fruiting and yield in pomegranate var. Bhagwa under Tamil Nadu conditions**Ranjith, RK., S. Senthilkumar* and S. Manivannan***Central University of Tamil Nadu, Thiruvarur-610 005, Tamil Nadu***Purpose**

Pomegranate (*Punica granatum* L.) occupies a significant position as commercial fruit crop in international arena. Tremendous role of plant bio-regulators in commercial pomegranate production have been seen over period of time, in which their remarkable value with the pomegranate variety Bhagwa need further investigation with their performance over flowering, fruiting, yield and quality characters under Tamil Nadu Conditions. With this background, we aim to study the impact of certain plant bio-regulators on induction of flowering, fruiting and yield in pomegranate var. Bhagwa.

Methods

Six-year-old pomegranate plants of Bhagwa variety were utilized for the experimentation purpose. All new shoots from the plants in the experimentation plot were pruned uniformly before the application of treatments. The experimentation was laid in Randomized Block Design (RBD) comprising ten treatments of various plant bio-regulator at different concentrations which were replicated thrice.

Results

For the observations recorded on floral characters, higher the 'percentage of hermaphrodite flowers' registered with Ethrel (300 ppm) (68.33 %). Among percentage for fruit set, higher the value recorded in Ethrel (300 ppm) (65.50 %) whereas, higher the 'number of fruits per plant' was registered with Paclobutrazol (4ml/plant) (51.00). With regard to major yield related traits, higher the 'fruit weight' (219.66 g) and 'yield per plant' (11.60 Kg) was recorded in Paclobutrazol (4ml/plant).

Conclusions

The present investigation revealed that the plant bio-regulator applications with Paclobutrazol (4ml/plant) impacted major fruiting and yield traits in pomegranate var. Bhagwa.

Keywords: *Pomegranate, Bhagwa, Plant bioregulators, fruiting and yield traits.*

Effect of tillage practices and mustard based cropping systems on Soil Quality under Rainfed Agroecosystems of N-W Himalayas of India**Tanjot Kour, Sarabdeep Kour, and Shesh Narayan Kumawat***Soil Science and Agriculture Chemistry, SKUAST-JAMMU***Purpose**

The ability of a specific soil type to perform within its limits and within naturally occurring or managed ecosystem boundaries, to sustain plant and animal productivity, maintain or improve water and air quality, and to support human health and habitation is known as soil quality. Due to the interaction of climatic, soil, plant, and human factors, maintaining soil quality at a suitable level is extremely complex process and under rainfed conditions, this problem is more difficult to solve. In order to reduce soil degradation or keep soil quality at a suitable level, it is necessary to use proper soil and crop management strategies. Therefore, conservation tillage practices can be used as a strategy to improve the soil fertility and soil quality.

Methods

The study was conducted in already established permanent experimental plot comprising of 12 treatments arranged in split plot design with three replications. Three tillage systems namely

Raised beds (RB), Zero tillage (ZT) and Conventional tillage (CT) was arranged in main plots with four Mustard based cropping systems namely Mustard-Green gram (M-G), Mustard-Pearl millet (M-P), Mustard-Sesamum (M-S), and Mustard-Maize (M-M) arranged in sub plots. To determine the soil quality index, Sharma et al. (2005a) explained four major processes in determining the soil quality index: 1) define the goal, 2) select a minimum data set (MDS) of indicators that best represent soil function, 3) score the MDS indicators based on their performance of soil function, and 4) integrate the indicator score into a comparative index of soil quality. Statistical analysis was done using Principal component analysis (PCA) to select significant variables. The variables with high factor loading and principal components (PC) with high eigen values were believed to be the variables that best reflected system characteristics.

Results

Selected indicators in MDS were scored into dimension less values ranging from 0 to 1 using linear scoring method. For all the selected indicators i.e., SMBC, Clay content, pH and Silt content (higher is better) indicators are chosen, each value of indicator was divided by the highest value such that the highest value received a score of 1. The indicator score was then multiplied by the weighting factor derived from the PCA to obtain the ultimate index value for soil quality under different land uses. The weight of each PC based on per cent variance to total variance ranged from 0.1059 to 0.555. Soil quality index (SQI) developed for tillage systems varied from 0.263 to 0.315 with zero tillage resulting in a significant soil quality index. In case of cropping systems, Mustard-Maize resulted in the highest mean value of soil quality index (0.300). However, the results were non-significant for the cropping systems.

Conclusions

The results after four years of cropping cycle proved the hypothesis that ZT along residue retention of leguminous crops improve the soil quality parameters. Leguminous based cropping system is an efficient management strategy for improving soil quality and fertility under rainfed ecosystems. Thus, the results concluded that the adoption of ZT along with Mustard-Green gram cropping system can address soil related constraints and improve soil quality in rainfed regions.

Keywords

Soil Quality, Rainfed Area, Zero Tillage, Conventional Tillage, Principle Component Analysis.

Physico-Chemical Analysis of Traditional Water Sources Present Around River Lohawati in District Champawat, Uttarakhand

Lata Kharkwal¹, Dharmendra Kumar^{2*}

1. S.V. Govt .P.G College Lohaghat, Department of Zoology, Uttarakhand, India (262524)

2. Government. P.G. College Maldevata, Raipur, Dehradun, Uttarakhand, India (248008)

Abstract

Purpose: This study was conducted in the Lohaghat region of the District Champawat, in this area river Lohawati is the primary source of potable water, but due to Urbanization and increasing population, the water of river lohawati is not sufficient according to the water need of this city, especially in summer season when the water level of Lohawati reduces, this region faces a serious water crisis. In this study quality of the traditional water sources (natural aquifers), which are called Naula in the local language has been investigated so that the alternative of the river can be found and exploitation of the river for water can be reduced.

Methods:

Samples were collected between April to September 2022 and tested in the laboratory of S.V.G.P.G College Lohaghat. Samples are collected in 250 ml polypropylene sampling bottles, all

samples were collected according to the guideline of BIS. Analysis of the samples was done by various methods: pH was analyzed by electrometric method, Conductivity and temperature were analyzed by a Digital conductivity meter (HM digital AP-2 Aquapro), and Laboratory thermometer (Omsons) respectively. TDS was calculated by the gravimetric method. Total Hardness, Magnesium, and Calcium were analyzed by EDTA titration.

Results:

All the samples were found within the range of BIS, the values of tested parameters are as follows: the temperature was recorded between 16.6 to 18.8°C, hardness was 141-147 mg/l, calcium, and magnesium were between 22-30 mg/l and 18-20 mg/l respectively, TDS was 110-132.6 mg/l, EC was recorded between 485 µs/cm- 622µs/cm and the pH of these samples was found between 7.2 to 7.4. This result indicates that all these samples are safe for human consumption.

Conclusion:

Naula (Natural aquifer) are traditional water bodies of the Kumaun region, these are old traditional water heritage of Kumaon, some of these aquifers were constructed during the seventh or eighth century, even being so old the water of these sources is still potable, but due to lack of maintenance these sources are getting destroyed, if these sources are properly maintained, then these can be helpful in reducing the dependency of people of this area on the river.

Keyword: Naula, water quality, physicochemical, BIS.

Noxious weeds of moradabad district, Uttar Pradesh, India.

Sachin Sharma*, Prof. Shambhu Prashad Joshi & Manisha Pandey

Eco-Taxonomical Research Laboratory, Botany Department

D. A. V. (P. G.) College Dehradun, Uttarakhand, India. 248001.

[Hemvati Nandan Bahuguna Garhwal (A Central University) Srinagar, Garhwal, U.K. India]

Purpose

To create a comprehensive and ecological account of various noxious weed species from agriculturally productive and non-agriculturally productive land areas, for the effective control of the weed and its impact. Noxious weeds have a rapid rate of reproduction and dissemination, and they use complex techniques to escape man's efforts to eradicate them. (Das 2008).

Methods

This botanical study was based on extensive and intensive field illustrations conducted during the period of Apr 2021 – May 2022 in 08 blocks of district Moradabad i.e., Thakur dwara, Dilari, Chhajlait, Bhagatpur Tanda, Moradabad, Munda Pandey, Deengarpur and Bilari. During the period of present study 10 sampling sites were randomly selected in each block for field observation, sample collection and interviews were conducted from farmers and local inhabitants of each site about noxious weeds and their impacts on agricultural crops, livestock and human beings also.

Results

A total of 25 noxious weeds belonging to 02 monocot and 23 dicot families of APG-IV system were reported from the study area. The predominance of weed species was shown by family Asteraceae having 7 noxious weed species followed by Poaceae and Convolvulaceae 3 species each. Among the recorded noxious weed species were mostly (7 species) related with Campanulids grade of APG-IV. Study reveals that mostly weeds showing the native range as Tropical America. Mostly noxious weeds were recorded from the agricultural ecosystem followed by waste places and along the road sides also of Moradabad district.

Conclusion

Economy of farmers and agriculturalists is harmed by noxious weeds. They out-compete native plants, diminishing the amount of food available for livestock grazing.

Keywords: Noxious, Weed, Moradabad, APG-IV.

A contextual sentence about your motivation behind your topic

“Noxious weed is a plant that has been recognised as harmful to public health, agriculture, recreation, wildlife, or property by the government of a country”

A descriptive statement about the types of literature used in the review.

“Floras of the concern study area”.

Summarize your findings.

“A total of 25 noxious weeds belonging to 02 monocot and 23 dicot families of APG-IV system were reported from the study area. The predominance of weed species was shown by family Asteraceae having 7 noxious weed species followed by Poaceae and Convolvulaceae 3 species each.”

Conclusion(s) based upon your findings.

Economy of farmers and agriculturalists is harmed by noxious weeds.

“These weeds affect humans and livestock by producing large amounts of pollen and chemicals that cause severe allergies, skin irritation, and eye discomfort”.

Reference.

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India's regional anemia prevalence patterns and their impact on women and children

Geetha M.L^a, Dr. Pramod Kumar^a, Raghavendra K.J^b, Dr. Nityashree M.L^a and Dr. Dharam Raj Singh^a

a: ICAR-Indian Agricultural Research Institute, New Delhi

b: ICAR- Indian Institute of Farming Systems Research, Modipuram

Purpose:

A vital aspect of health and development is nutrition. While malnutrition, in all its forms, poses major risks to human health which also includes anemia, a condition marked by low haemoglobin levels, it becomes imperative to conduct an in-depth study of temporal and spatial variations in anemia on women and children.

Methods:

The study uses the unit level data collected through The Demographic Health Survey Program's (DHS) data distribution system (www.DHSprogram.com) from the recent 5th National Family Health Survey (NFHS), 2019-21, with the help of statistical tools such as percentages, and tables to display the prevalence of anemia in different age groups, genders, regions, and other variables. To assess the likelihood of prevalence of anemia in women between 15-49 years of age by using a logit model.

Results:

Revealed that anemia prevalence remained high among rural children, with the highest rates found among children aged 12-17 months. Logit results revealed that women in rural areas, with children, and who are nursing are more likely to be anaemic and was inversely related to a rise in age, education, and wealth status and was observed to be more prevalent in the eastern region.

Conclusion: A holistic nutrition-based approach should be prioritized, with a focus on high-risk groups of children and women, to effectively address anemia.

KEYWORDS: Nutrition, Malnutrition, Anemia, Haemoglobin, National Family Health Survey (NFHS)

Valuation of Carbon Sequestration Based on Land Cover Change and Land Use in Kerala, India Using Invest Model
Omprakash Naik^a, Dr. P.Venkatesh^a, Dr. Alka Singh^a, Dr. Dharam Raj Singh^a, Dr. Girish Kumar Jha^a, Dr. Dinesh Kumar Sharma^a, Dr. Sangeetha Velaichamy^a and Nandini Saha^{a*}

a: ICAR-Indian Agricultural Research Institute, New Delhi

Purpose

Over the past decade, India has experienced dramatic land-use changes including a decline in cropland, increases in forests, and accelerated expansion of urban areas. As per FSI Report 2021, a large increase in forest cover in Kerala State are due to plantation & conservation activities. If these changes in land use continue, it leads to important effects on biodiversity, climate change, international trade, and other policy issues. Hence Land use has figured prominently in international negotiations on climate change. Under the Kyoto Protocol, countries can claim credit for offsetting carbon dioxide (CO₂) emissions through changes in land use and land management. Hence the valuation of ecosystem services has recently become an important area of research. We evaluated carbon sequestration in different land cover and land use in Kerala.

Methods

For the Valuation of ecosystem services InVEST (Integrated Valuation of Ecosystem Services and Trade-off) model has been used, a unique study in the Indian context. InVEST runs as a standalone model through GIS data. This model requires biophysical characteristics of the study area's (Kerala) landscape such as land use/land cover (LULC) data, and such data has been used for the mapping and quantification of carbon and Socio-economic data i.e., the social cost of carbon used for the valuation. The data were obtained for the period of 2015-16 from ESRI, Sentinel-2 data, IPCC report and a Report from a forest survey of India.

Results

Of Kerala's total land area, forests made up 54.70 percent, which has the potential to store 529.08 million tonnes of carbon with a social cost of carbon valued at 16,930 (million US\$) during 2015-16. Other land use types such as cropland, wetland, Grass and shrubs' social costs of carbon are estimated to be 922, 822, 75 and 972 (million US\$) respectively. The sum of the values of all the land use types represents the total social cost of carbon estimated to be 19,730.03 (million US\$).

Conclusions

In this study, detailed research on carbon sequestration in the different landscapes and the economic values of the corresponding landscapes were undertaken in the Kerala state. Our results provide potential policies to improve carbon sequestration of afforestation campaigns such as the Compensatory Afforestation Programme. Additionally, in monetary terms, from cropland, farmers can increase carbon sequestration by adopting conservative agricultural practices, which will be additional income for the farmer by selling carbon credits. It requires a small amount of investment (for afforestation) in exchange for substantial carbon sequestration benefits.

Keywords: Carbon Sequestration, Land Use and Land Cover, InVEST model and Social Cost of Carbon

Assessment Of Integrated Management Technologies In *Bt*-Cotton Under Drip Irrigation.**Ashok S. Jadhav, Prashant B. Jadhav* And Digambar D. Patait***Cotton Research Scheme, Vasantrya Naik Marathwada Krishi Vidyapeeth, Parbhani- 431401***Purpose:**

Monopodial branches do not produce bolls but they compete for nutrients and water and De-topping practice reduces lodging and increases yield of *Bt*-Cotton. Therefore a field experiment entitled "Assessment of integrated management technologies in *bt*-cotton under drip irrigation was conducted.

Methods:

An experiment entitled "Assessment of Integrated Management Technologies in *Bt*-Cotton under Drip Irrigation" was conducted at Water Management Research Scheme, Vasantrya Naik Marathwada Krishi Vidyapeeth Parbhani (M.S.) during the year 2021-22 and 2022-23 in randomized block design design with three replications. The experiment comprised of eight treatments T₁- Control Wider Planting (150 X 30 cm), T₂- Control HDP (90 X 30 cm), T₃-Removal of Monopodia at 60 DAS (HDP), T₄- De-topping at 75 DAS (HDP), T₅- Removal of Monopodia at 60 DAS + De-topping at 75 DAS (HDP), T₆- Spraying of Mapiquate Chloride @ 25 g a.i. at 60 DAS (HDP), T₇- Use of Polymulch (HDP) and T₈- Polymulch + Removal of Monopodia at 60 DAS + De-topping at 75 DAS (HDP).

Results:

The results obtained from this experiment shows that growing of cotton under polythene mulch along with removal of monopodia at 60 DAS and de-topping at 75 DAS (T₈) recorded significantly highest no. of bolls per plant (46.04, 37.23 and 41.65), yield plant⁻¹ (139.53, 154.13 and 146.83 g plant⁻¹) and boll weight (4.58, 6.51 and 5.54 g), seed cotton yield (3314, 3911 and 3613 kg ha⁻¹) and GMR (Rs. 314830, Rs. 391087 and Rs 352958 ha⁻¹) as compared to all other treatments respectively during 2021-22, 2022-23 and in pooled analysis of the experiment, while removal of monopodia at 60 DAS and de-topping at 75 DAS (T₅) recorded significantly highest NMR (Rs.185301, Rs.237401 and Rs. 211351 ha⁻¹) and Benefit: Cost ratio (3.28, 3.24 and 3.26) during 2021-22, 2022-23 and in pooled analysis respectively as compared to rest of the treatments in *Bt*-cotton grown under micro irrigation.

Conclusion:

Growing of cotton under polythene mulch along with removal of monopodia at 60 DAS and detopping at 75 DAS is found to be beneficial for getting higher seed cotton yield and GMR in *Bt*-cotton grown under micro irrigation. Removal of monopodia at 60 DAS and detopping at 75 Das found to be beneficial for getting highest net monetary returns and B:C ratio in *Bt*-cotton grown under micro irrigation.

KEYWORDS: Cotton, Drip Irrigation, Removal of Monopodia, De-topping, Plastic Mulch, Growth, Yield, Yield Attributes.

Fruit and Seed Source Variation of *Ziziphus jujuba* Mill- A drought hardy tree species in Kashmir Himalaya.**Firdous A. Shiekh, M. Maqbool Rather* P. A. Khan and Ashfaq A. Mir***Division of Forest Biology & Tree Improvement, Faculty of Forestry, SKUAST-K, Benhama, Ganderbal (J&K).***Purpose**

Ziziphus jujuba Mill. is one of the most important genera of Rhamnaceae or bulk thorn family with fruits rich in nutrients, and famous for the sweet, apple-like taste with potassium, phosphorus, calcium and manganese being the major mineral components, as well as iron, sodium, zinc and

copper. It is highly tolerant to drought and well adapted to diverse climatic conditions and not only survives but produces reasonable yield and growth under severe drought assisted by its deep and substantial taproot. Seed source variation is an important tool in tree improvement programs that involve the selection of superior trees for seed collection and subsequent propagation. The aim of the study was to investigate the fruit and seed variations in *Ziziphus jujube* sources.

Methods

Tree exploration was carried out in 3 *Ziziphus jujuba* habitats-Budgam district, Baramulla district, and Ganderbal district of the Kashmir valley. Two sites were selected from each of the three districts based on the presence of this species.

Results

Significant variation was observed in different fruit parameters (fruit length, fruit diameter, dry fruit weight, and dry pulp content), as well as seed parameters (seed length, seed diameter, seed weight, seed moisture content and seed germination). The results showed that fruits and most of the seed parameters collected from Lar Ganderbal source had the highest values viz fruit length (15.14 mm), fruit diameter (14.25 mm), dry fruit weight (8.08 g), dry pulp content (56.85 g), seed length (11.55 mm), seed diameter (7.31 mm), and seed weight (16.03 g). But seed moisture content (10.70 %) and seed germination percentage (75 %) was observed the highest from Wahabpora Budgam source.

Conclusions

Sources evaluated revealed that Lar, Ganderbal source can be exploited for fruit parameters while as Wahabpora, Budgam source can be utilized for propagation and future research programs to understand the underlying factors contributing to the observed differences and to explore the potential applications of this variability.

Key words: *Ziziphus jujuba*, Kashmir valley, Drought tolerant, Fruit & Seed variation, Source variability, Superior progeny.

***In Vitro* Assay of Guide RNA Efficiency for Editing *DST* Gene in Basmati Rice**

Meghna Mandal¹, Lakshay Goyal¹, Mehardeep Kaur², Rainy Singla², Dharminder Bhatia^{1*}

¹Department of Plant Breeding and Genetics, ²School of Agricultural Biotechnology, Punjab Agricultural University, Ludhiana, India-141004

Purpose:

Basmati rice is nature's exclusive gift to the Indian subcontinent. Basmati rice has been conferred with coveted GI (Geographical Indication) tag, and is one of India's biggest forex earners. In 2021-22, India exported 3948161.03 metric ton of Basmati rice worth Rs 26416.54 Crores (www.apeda.gov.in). Basmati rice, though remunerative, yields much lower than non-Basmati rice. While significant yield increase in Basmati has come through the way of reducing plant height, conferring lodging resistance and resistance to biotic stress, there is a need to directly target the yield component traits particularly grain number per panicle. Mutant alleles of *DST* (Drought and salinity tolerance) gene, a transcriptional factor for the gene *OsCKX2* (Cytokinin oxidase 2), have been shown to increase grain yield by increasing grain number per panicle. Additionally, mutant alleles of the same gene have also been reported to confer tolerance to drought and salinity tolerance in rice. Sequence information of both the mutants is available, therefore targeted mutagenesis using CRISPR-Cas9 based genome editing holds the potential of emulating the two mutant alleles in Basmati background.

Methods:

The *DST* gene sequence in variety Punjab Basmati 7 was amplified using overlapping primers. Two single guide RNAs (sgRNAs) were designed using CRISPR-P v2.0 to target sequences within the gene such that simultaneous cleavage at both the sites would result in the deletion of a >100 bp sequence from the middle of the gene. A bigger deletion would fulfil two purposes- easy screening of mutation in putative edited lines, as well as much higher chances of disrupting the C-terminal function of the translated protein. The two designed sgRNA had efficiency score of 0.3977 and 0.2133, while their respective GC-content were 80% and 70%. The absence of secondary structures in the sgRNA scaffold was confirmed using OligoCalc and RNAFold Web Browser. The sgRNAs were then tested for their efficacy of cleaving the target DNA sequence under in vitro conditions. Guide-it™ sgRNA In Vitro Transcription and Screening Systems, manufactured by Takara Bio USA, Inc. was used to carry out the in vitro cleavage (IVC) assay. Primers corresponding to each sgRNA were specifically designed for IVC as per manual/ protocol. The sgRNA template was amplified and then transcribed using the Guide-it sgRNA In Vitro Transcription Kit. The sgRNA thus produced was checked for its concentration colorimetrically; a concentration > 500ng/μl was favoured. The sgRNA and gene sequence template were used to test in vitro cleavage efficiency using the Guide-it sgRNA Screening Kit. Cleavage was confirmed using gel electrophoresis.

Results:

The two sgRNAs chosen from CRISPR-P v2.0 did not have any possibility of forming secondary structures (hairpin, self-annealing sites), as confirmed using OligoCalc and RNAFold Web Browser. Gel electrophoresis revealed that the template DNA of the gene (679 bp) had been cut into two fragments by both the sgRNAs. The size of the fragments generated after IVC confirmed to the expected size of the cleaved fragments. The length of the genomic template amplified was 679 bp. Guide 1 was to cleave at about 358 bp, generating two bands of sizes 358 and 321 bp respectively. Gel images confirmed that the cleaved bands corresponded to the expected size. Similarly, guide 2 was designed to cleave at 535 bp, generating two fragments of sizes 535 bp and 144 bp. The same was evident in the gel image.

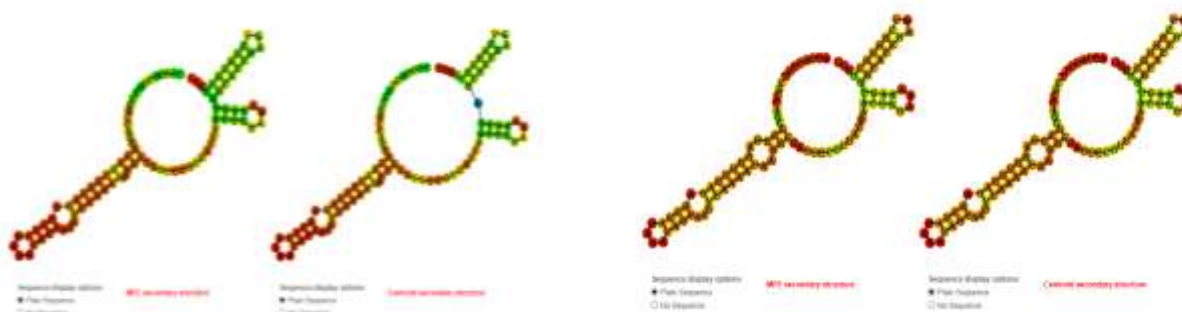


Fig 1A and B: Secondary structure of sgRNA+scaffold for Guide 1 and Guide 2, as predicted by RNA Fold Web Browser

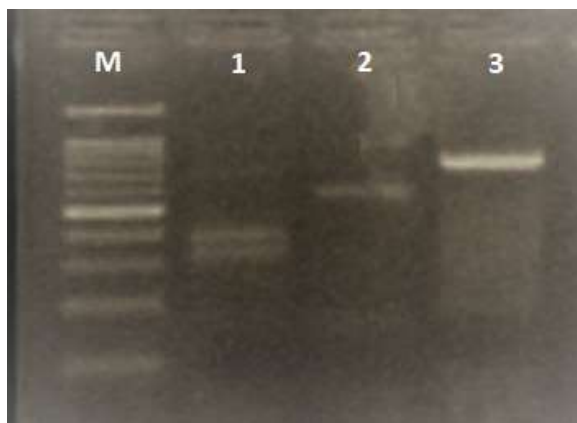


Fig 2: *In vitro* DNA cleavage using Cas9 nuclease and sgRNAs. Lane M: 100 bp ladder, Lane 1: fragments obtained after IVC using Guide 1, Lane 2: fragments obtained after IVC using Guide 2, Lane 3: control (uncleaved) fragment

In both the cases, a fraction of the uncut band was visible on the gel. However, its intensity changed, depending upon the ratio of Cas9 nuclease

and genomic DNA template used in the IVC reaction.

Conclusions: The designed sgRNAs show good cleavage efficiency under *in vitro* conditions. The two sgRNA sequences thus tested can now be cloned into a suitable vector (pRGEB32) simultaneously, generating a polycistronic tRNA-gRNA (PTG) construct, which can then be used for genome editing *in vivo*.

Keywords: Basmati rice, DST gene, CRISPR/Cas9 single guide RNA (sgRNA), *in vitro* cleavage (IVC)

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Microbiome In Water & Soil As Promising Probiotic In Aquaculture(From Molly Fish) For Growth Promoting Rhizobacteria (PGPR)For Sustainability.**Pratibha Kulkarni***Osmania University Hyderabad Alumni***R.S.Kulkarni B.E,***Industrial automation Expert.***Introduction**

Organic aquaponics is gaining importance for its healthy method of growing fish and plants like leafy vegetables, medicinal plants and even cereal crops for their mutual benefits. Aquaculture fisheries seem to have an important role in increasing food productivity in an eco-friendly manner for sustainability to cover-up shortage of land cultivation problems to some extent.

Objectives:

Keratin and chitin solubilisation in the experimental fish tank aquaponic system and there is luxurious plant growth.

Isolation, identification and characterization of the fish gut bacteria.

Methods :

This study is basis for assessing the general health of fish and plants with identification of water microbiome by Metagenomics. Microbiome colonizes plant roots with Plant Growth Promoting Rhizobacteria.

Results

Bacteria from fish gut for bioactive compounds released into Fish tank and the microbiome of *Asparagus* root are showing keratin degradation and chitin degradation.

Isolated colonies were identified as *Bacillus* species and confirmed by rRNA analysis and 16s sequence as *Bacillus cereus*

Conclusions:

Bacillus cereus acts as a probiotic in aquaculture systems.

SIGNIFICANCE OF THE RESEARCH: There is immense scope for Food, Dairy, Textile, Cosmetic, Leather industries, Probiotic in Fish & Prawn culture, Agriculture for Bio-pesticide & Bio-fertilizer, Bioremediation of heavy metals and plastics. Live fish and fish tank contains Plant growth promoting bacteria (PGPR).

Silvoarable systems for food and biomass production in semi-arid areas**N. Kaushik^{1*}, Neelam. K. Mandal², Kajal¹ and B.S. Mandal³**¹*CCS HAU College of Agriculture, Bawal-123501, Rewari, Haryana (India)*²*Govt. (PG) College Panchkula,* ³*Directorate of Extension Education, CCSHAU, Hisar***Purpose**

Rapid increase in demand of food, fodder and energy is becoming a threat to natural resources (land, water, vegetation etc.) in arid and semi-arid regions (Mouat and Lancaster 2008). Harsh climatic conditions such as low and uneven rainfall, poor soil and high temperature have made the agriculture risky in these regions. Most of the lands in these areas are on the verge of degradation and have low biodiversity, vegetation cover, soil fertility and productivity. Growing of trees in the existing food systems can meet the farmers' basic needs of food, fodder and fuel wood without further degradation of land in these areas. Silvoarable systems (Planting of trees with agricultural crops) have been found economically viable, environment friendly and alternate source of income. Wood systems, such as silvoarable, have the potential to sequester carbon and offset the global warming.

Tree based systems have can improve and conserve the natural resources and an adaptation to climatic change in dry regions. Some of them improve the microclimate, ameliorate soil structure and water infiltration and sequester carbon in wood and soils. Thus, help farmers to adapt to climate change through the risk-mitigating effects of additional farm products derived from trees, positive microclimatic conditions and enhanced farm productivity through nutrient and water cycles.

Now the challenge is to find out the best silvoarable layout that produce biomass while at the same time providing food. To answer this problem, the authors conducted experiments to assess the performance of silvoarable systems with different planting geometry and intercropping different crops for food and biomass production in semi-arid regions of India.

Methodology

a). *Ailanthus excelsa* based system:

The study was conducted with different plant geometry of *A. excelsa* i.e. 10x20; 10x10; 10x6.5 and 10x5 m intercropped with crop sequences viz., pearl millet (*Pennisetum americanum* (L.) R. Br) – Indian mustard (*Brassica juncea*), cluster bean (*Cyamopsis tetragonoloba*) Taub) -wheat (*Triticum aestivum*).

b). *Prosopis cineraria* (Khejri) based system:

The experiment was conducted in 20 years old *Prosopis cineraria* based silvoarable system. The system comprised of Khejri trees planted at a spacing of 6 x 5 m with field crops cowpea (*Vigna unguiculata*), clusterbean (*Cyamopsis tetragonoloba*) and pearl millet (*Pennisetum americanum*).

Results

The silvoarable systems were found more productive and economic when compared with sole cropping of arable crops, however yield reduction was noticed with the maturity of the systems. The results are presented as under:

Ailanthus excelsa based system: The silvoarable system with Indian mustard under 10x5 m plant geometry was found most remunerative, as the maximum net returns (Rs.100,140 ha⁻¹) and benefit to cost ratio (2.84) were observed with this system. Maximum biomass 28.6 t ha⁻¹ from trees and 5.9 t ha⁻¹ from wheat under 5x4 m geometry can be potential feedstock for biofuel production on sustainable basis.

Prosopis cineraria (Khejri) based system: The Maximum fodder yield was recorded in pearl millet and minimum in buffel grass when the fodder crops were grown either sole or in association with trees. The average increase in yield of green fodder due to canopy cover of the *Prosopis* trees was of the order of 24.1%, 25.4% and 12.3% in cowpea, pearl millet and clusterbean, respectively.

Conclusion: The results showed that agroforestry (silvoarable) systems may ecologically advantageous land use system for food and biomass production on sustainable basis as silvoarable systems have positive effect on soil fertility (OM, available P and K) as compared to sole cropping and with the advancement of age of trees soil health is anticipated to be further benefited.

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Investigation on Biomass Distillation System for Essential Oil Extraction**Rinju Lukose, S. R. Kalbande, Prajakta Phadtare***Department of Unconventional Energy Sources and Electrical Engineering, Dr. PDKV, Akola – 444104, India***Purpose**

Renewable energy sources such as solar energy, wind, biomass, biofuels etc are widely considered to reduce total energy consumption which is still dominated by fossil fuels, and to mitigate greenhouse gas emissions. Essential oils are volatile chemical compounds extracted from plant materials and are widely used for various applications such as aromatherapy, food, fragrance, medicines (antifungal, antibacterial, antioxidant, anti-inflammatory, etc.), and cosmetics.

Methods

The biomass distillation system consists of a combustion chamber, distillation still, condenser and Florentine flask. The agro-residue briquettes were used as the fuel for combustion in distillation system. Experiments were conducted by varying the feedstock quantity (2kg, 4 kg and 6 kg) and particle size (1.5 cm, 3 cm and 4.5 cm) of lemongrass.

Results

The essential oil yield was maximum for 6 kg and 3 cm size of lemongrass. The system productivity was maximum for 4 kg and 3 cm size whereas it was minimum for 2 kg and 1.5 cm size. The quality of lemongrass essential oil obtained by biomass distillation system was characterized by its high geraniol content.

Conclusions

Biomass distillation system is an efficient and sustainable method for essential oil extraction from medicinal plants.

Keywords: Biomass, Distillation, Extraction

The ecological study of waterborne disease-causing bacteria in natural drinking water sources in Pithoragarh, Uttarakhand”**Shailu Garkoti***Department of Zoology, L. S. M Government P.G College, Pithoragarh, Uttarakhand- 262502, India,***Purpose**

Water is the most important element for the human body, and adequate water intake is necessary. It is vital for all known forms of life; it is the only substance that exists naturally in all three states at temperatures and pressures commonly experienced on Earth. The state of Uttarakhand has various natural water sources, which supply water to the large population and are the main sources of drinking in different areas. Due to this, most of the population uses this water without treatment, which leads to waterborne diseases such as dysentery, diarrhea, cholera, etc. The main aim of this research work is to identify the bacteriological investigation.

Methods

The present study is conducted in Pithoragarh city and its nearby villages, different natural water sources were selected for this study, and microbiology analysis was done by using various culture media such as EMB for *E.coli*, XLD for *Shigella*, BGA for *Salmonella*, etc.

Results

This study clearly shows the presence of harmful microorganisms in the natural water sources of Pithoragarh, all samples were found contaminated by various microorganisms. *E.coli* was present

in the highest number among other microbes, *salmonella*, and *shigella* were also abundant in the natural sources.

Conclusion

This study indicates that these natural water sources are not potable for drinking purposes; it is suggested that water can be purified through various methods such as boiling and filtration. Overall, drinking clean and safe water is crucial for maintaining good health and preventing waterborne diseases.

Keywords: Natural water sources, Culture media, Water borne diseases, Microbes

Impact of foliar spray of nutrients and growth regulator on leaf mineral composition of ber cv. Apple ber

Sumit, Satpal Baloda

Department of Horticulture CCS Haryana Agricultural University, Haryana, India

Abstract

The research was conducted at the Experimental Orchard of the Department of Horticulture, CCS Haryana Agricultural University, Hisar in the year 2020–21, to study the impact of foliar spray of nutrients and growth regulators on leaf mineral composition of ber cv. Apple ber. During the first and last weeks of October, plants were sprayed with urea (1.5, 2.0 and 2%), ZnSO₄ (0.25, 0.5 and 0.75%), K₂SO₄ (1.5, 2.0 and 2.5%) and GA₃ (20, 40 and 60 ppm). Significant improvement in the leaves nutrient concentrations was obtained over control. Maximum nitrogen, was noted with the application of urea @ 2.5% per cent treatment followed by urea @ 2.0%, urea @ 1.5% and ZnSO₄@ 0.75 per cent treatment. Foliar spray of potassium sulphate @ 2.5 per cent resulted in significantly maximum phosphorus, potassium concentration which was at par is potassium sulphate @ 2.0 per cent treatment excepturea and zinc. Potassium sulphate increased the leaf phosphorous and potassium content but vice-versa with urea treatments. Maximum Zn content in leaves was recorded with foliar application of ZnSO₄ (0.75%) which was at par with ZnSO₄ (0.5%) treatment.

Methods

Nitrogen

Nessler's reagent method as per standard procedure described by Jackson (1973) was used for calculating nitrogen.

Phosphorus

Phosphorus was determined by Vanado-molybdo phosphoric yellow color method (Koenig and Johnson, 1942).

Potassium

Potassium was determined on flame photometer as described by Jackson (1973).

Zinc

The DTPA extractable Zn and Fe was estimated by using the method of Lindsay and Norvell (1978). The digested leaf samples were analyzed for determining zinc concentration on atomic absorption spectrophotometer and their contents were expressed in ppm.

Conclusion

Nutrient status in ber leaves was significantly higher with foliar applications of nutrients and plant growth regulator. Leaf phosphorous and potash contents increased with foliar spray of K₂SO₄, whereas, N and Zn content of leaf were increased with foliar spray of urea and ZnSO₄.

Keywords: ber, foliar spray, leaves, nutrients

Genetic divergence studies for grain nutritional and agro-morphological traits in Pearl millet Kavita¹, Dev vart¹, Ramesh Kumar¹, R. N. Sheokand² and Vinay Kumar¹¹Department of Genetics and Plant Breeding, COA, CCS Haryana Agricultural University, Hisar²Department of Math. And Statistics, COBSH, CCS Haryana Agricultural University, Hisar**Purpose**

Calcium and magnesium deficiency have serious health consequences in adults and children particularly in underdeveloped nations. Pearl millet, being naturally gifted with higher proportions of grain minerals (Fe, Ca, Zn, Mg, P and K), protein, starch and fibre is considered as a potential crop to combat micronutrient malnutrition. In present study, we aim to determine genetic divergence among selected pearl millet germplasm lines for grain nutritional and various agro-morphological traits.

Methods

Fifty germplasm lines (comprised of B- and R-lines) were evaluated for genetic divergence in randomized block design with two replications at Bajra Section, Department of Genetics and Plant Breeding, CCSHAU, Hisar during *Kharif* (Rainy) 2020. Observations were recorded for traits *viz.*, days to 50% flowering, panicle diameter, panicle length, plant height, number of productive tillers per plant, dry fodder yield per plant, 1000-seed weight and grain yield per plant. Grain Ca and Mg of each genotype were estimated by using ICP-MS. D² analysis was performed to determine degree of diversification and relative proportion of each component character to the total divergence.

Results

Based on D² value the experimental material was grouped using ten quantitative traits into six major cluster and cluster IV possessed maximum number (13) of genotypes. Higher inter-cluster distance was observed than intra-cluster distance. The maximum intra cluster distance was observed in cluster V (3.712) and the maximum inter cluster distance was observed between cluster IV and cluster V (5.963) followed by cluster IV and cluster VI (5.060). Highest percent contribution to the total variability was due to grain Ca content (39.59%) followed by grain yield per plant (16.24%) and dry fodder yield per plant (12.08%).

Conclusions

On the basis of divergence study, the genotypes from clusters IV (HMC-283, GP-141, GP-176 and GP-181), V (HR-1032, ICRI 1499, GP-227, HR-1038 and HRI-115) and I (HI-1012, HR-607 and HI-1013) having most diverse parents could be used in hybridization programme to develop most promising hybrids.

Keywords: D² analysis, Genetic divergence, Grain minerals, Pearl millet and Malnutrition

Seed quality enhancement by hydro-priming technique in barley**Shivani^{*1}, V S Mor¹, Axay bhuker¹, Hemender Tanwar¹ Pradeep Dalal¹ and Nidhi¹**¹Department of Seed Science and Technology, Chaudhary Charan Singh Haryana Agricultural University, Hisar 125004, India**Purpose**

Cereals has good storability and maintaining quality traits while barley has low storability due to biotic and abiotic stress. As a result, the carryover barley seeds are more likely to deteriorate and become unsuitable for sowing. With pre-sowing priming techniques, seed quality traits can be enhanced and encourage higher germination from carryover seeds. Keeping all these aspect into consideration, a comparative investigation was carried out between fresh and carryover barley seed to understand the influence of seed priming techniques in enhancing seed quality traits. Hydro-priming is a traditional pre-sowing method for efficiently enhancing the seed quality.

Methods

Hydro stands for water and priming is the process of soaking seeds in a suitable solution for a short period of time without radicle protrusion, followed by a drying back to normal moisture content in preparation for sowing. In an experiment, Barley seeds (BH-946) were primed with water for different durations *i.e.* 4, 8, 12, 16, 20, 24 using three different water volumes, including half, equal and double (w/v) and priming temperatures, comprising of 15°C, 20°C, 25°C and 30°C. The unprimed seeds (dry seed) taken as control.

Results

The combination of 8 hours priming with equal volume of water at temperature 20°C was found superior for all the three lots under such investigation. Among different volumes, equal volume was preferred over half and double volume because it resulted into uniform soaking as compared to half volume while in the case of double volume, anaerobic conditions developed in seeds. The aforementioned condition causing deterioration of seed and therefore, normal germination was hampered. The substantial differences between hydro-priming approaches and controls were seen in seedling growth parameters, vigor indices and speed of germination. Among all the three lots, maximum enhancement was recorded in one year old seed lot followed by two years old and the minimum enhancement were found in fresh seed lots.

Conclusion

The overall performance in terms of physiological parameters was observed with 8 hours soaking in equal volume at 20°C temperature for all three lots.

Keywords: Hydro-priming, carryover seed, Seed quality, Seed deterioration and Seed lot

Effect of time of planting and bio inoculants on days to opening of 1st floret and floret diameter

Divya¹, Arvind Malik¹, Raveena²

¹ Chaudhary Charan Singh Haryana Agricultural University, Hisar (125004), Haryana
² Maharana Pratap Horticultural University, Karnal (132001), Haryana

Purpose

Gladiolus is the leading flowering plant in the international cut flower trade. It is grown for its beautiful spike worldwide and is known as the queen of bulbous flowers. The time of planting and biofertilizers plays a vital role in obtaining better growth and flowering. The time of planting is indirectly related to the temperature and day length, both of which are important for the days to opening of 1st floret and floret diameter of Gladiolus. Proper planting time provides optimum growth conditions to plant for better growth with better floret diameter and minimum days to opening of 1st floret. While biofertilizers being a source of nutrients, plays an important role in flower growth and yield of a flower also depends on the nutrient status of the soil. More yield will generate more income for farmers. Keeping in view the above facts, the present study was carried out to study the effect of time of planting time and bio inoculants on the days to opening of 1st floret and floret diameter of Gladiolus.

Methods

The number of days taken from the planting of corms to the opening of the first floret in the spike of each tagged plant was recorded, and the average was calculated.

The diameter of the second floret of the spike in each tagged plant was measured by a digital vernier calliper.

Results

The results revealed that the days taken to opening of the first floret differed significantly for different time of plantings and bio inoculants. With a delay in the time of planting, the number of days taken to opening of the first floret increased significantly. The minimum number of days taken to opening of first floret (96.96) were recorded in 1st fortnight of October planting.

Among different bio inoculants treatment, the minimum number of days taken to opening of first floret (96.64) was observed in plants grown under T₈ treatment (RDF + *Azotobacter* + PSB + Mycorrhiza).

Conclusions

Under North indian conditions gladiolus can be planted on 1st fortnight of October and using bioinoculants treatment T₈ (RDF + *Azotobacter* + PSB + Mycorrhiza) to obtain optimum growth and yield. Better yield obtained generate more income for farmer and hence improve economic status of farmers.

Keywords: Gladiolus, bio inoculants, time of planting

Effect of season, and lactation status on follicular size distribution, oocyte development competency and embryo production in Sahiwal cattle

Venkata krishna Neerumalla, Sandeep Gandham, K. Veerabramhah

Sri Venkateswara Veterinary University, Tirupati.

Purpose

The use of Assisted Reproductive Technologies (ART) such as transvaginal ultrasound- guided ovum pick-up (OPU) and in vitro embryo production (IVEP) has significantly improved reproductive efficiency in the livestock sector. By managing these techniques, it is possible to enhance the quality of oocytes, leading to better outcomes in embryo production. This study aimed to explore how season (summer or winter) and physiological condition (lactating or non-lactating) impact follicular size distribution, oocyte development competency, and in vitro embryo production in Sahiwal cows.

Methods

The study involved 21 multiparous Sahiwal cows (aged 6-8 years), out of which 11 were lactating and 10 were non-lactating. The study spanned over a year, divided into two seasons: hot (April to September) and cold (October to March). The cows were given 10 µg GnRH at random stages of their oestrous cycle, followed by FSH (Folltropin-V™ or Stimufol) at subsequent doses of 100, 60, and 40 mg at 48, 60, and 72 hours after the GnRH administration. Follicular aspiration was performed after stabilizing the targeted follicle using ultrasonography. The protocols of COCs grading, *in vitro* culture, maturation, and fertilization were performed at the standard protocols.

Results

The study found that during the hot season, there was a lower proportion of medium-sized follicles (P<0.05), while non-lactating cows had a lower proportion of pre-antral follicles (small-sized) and a higher count of dominant follicles (large-sized) (P<0.05). Non-lactating cows also had a higher count of good quality (A+B+C) oocytes (P<0.05). Additionally, the count of matured and fertilized oocytes was higher (P<0.05) in non-lactating donors and cool-season collections. The study suggests that by scheduling OPU-IVP procedures during the cool season and using non-lactating donors, researchers and practitioners can improve the success rate of these ART procedures.

Conclusion

The source of hormonal protocols did not have any effect on the results. The study concludes that the quality of oocytes decreases during the summer season. Additionally, the study suggests that non-lactating cows are better donors for Ovum Pick Up-In vitro embryo production (OPU-IVP)

programs. These findings provide a framework for future research on in vitro embryo production programs in Sahiwal cows under various climatic and physiological conditions.

Key words Ovum pickup, heat stress, lactation, IVF, embryo production

Breeding Strategies For Sustainable Dairy Production Under Climate Change

S.P. Dahiya¹, Rohit Sharma¹, Parth Gaur¹, Renuka Hada²

Department of Animal Genetics and Breeding

¹*Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar, Haryana, India-125004*

²*Rajasthan University of Veterinary and Animal Sciences, Bikaner, Rajasthan, India-334001*

Purpose

India has largest livestock numbers in world and climate change is expected to adversely affect the milk production and reproductive functions of cattle and buffaloes in the country. To ensure sustainable dairy production, farmers need to adopt appropriate breeding strategies. The indigenous cattle possess climate resilient traits and considering using those traits to develop high producing breeds that can withstand high temperature in the face of climate change can be considered for sustainable dairy production under climate change.

Since the beginning of planning in India in the early 1950s, the emphasis of the country's livestock development policy has been on the crossbreeding of Indian cattle with exotic breeds. The objective was to enhance milk output, and as a result, around 26% of the dairy cattle in the nation are now exotic and crossbred which are producing higher milk yields, however, in general, the productivity of crossbred cattle is lower in areas where the mean annual temperature is higher due to environmental stress.

Due to climatic stressors in various areas of the country, India currently loses 1.8 million tonnes of milk production, and frequent climate change might cause a loss of over 3 million tonnes (MT) of milk production year by 2030. This has led to huge losses already and given climate change is occurring at a very fast pace and is dynamic in nature, there is no limit to the amount of losses which can occur in near future.

Since the crossbred cattle are more sensitive to temperature rise than indigenous cattle, a rise of 2-3°C due to global warming will have more impact on growth, puberty, and maturity of crossbred cattle, and the negative effects of heat stress will become even more apparent in the future if climate change continues as predicted (Ahmed *et al.*, 2015).

Literature Used

Research papers from reputed journals were used to summarise the findings in this abstract. The studies included mainly focused on difference between crossbred and indigenous cattle and gene responsible for climate resilience as well as effect of various stressors and their management which can affect the production economics of a farm.

The study undertaken by NBAGR, Karnal were also used in this abstract which revealed that indigenous cattle breeds/population found in different parts of India possess better heat tolerance and disease resistance as compared to exotic cattle breeds and their crosses.

The importance of various native breeds were also highlighted by NBAGR as well as other researchers for their importance in mitigating climate changes owing to better adaptability to various regions (like Umblachery, is ideal as a draught animal for the marshy rice fields; Bargur is ideal as a draught animal for agriculture in the uneven, hilly terrains; Badri, used as milch and draught animal, is suited for the hilly regions).

Results

The cross-breed population has considerably increased the production levels but they are also found to be more vulnerable to stress conditions (Narayan *et al.*, 2007). Karan Fries heifers had higher physiological responses (Respiration Rate, Pulse Rate, and Rectal Temperature) than Tharparkar heifers (Pandey *et al.*, 2013). Deb *et al.* (2013) carried out comparative studies on HSP90 expression among Frieswal and Sahiwal under in vitro and environmental heat stress and found the relative expression of HSP90 mRNA was significantly ($P < 0.05$) higher in Sahiwal compared to those in Frieswal.

As ambient temperature increases in the summer months, and as body temperature concomitantly increases, cows decrease their feed intake to mitigate heat stress (Ammer *et al.*, 2018), thereby leading to a gradual decline in milk production and a change in milk content. A study that investigated seasonal effects on milk yield showed that the milk yield of Holstein cows decreased by 10% to 40% in summer in comparison to the milk yield in winter (Preez *et al.*, 1990), further highlighting the influence of heat stress on milk production. Heat stress not only decreases milk yield, but also affects milk content and somatic cell count (Bertocchi *et al.*, 2014; Nasar *et al.*, 2017).

Consequently, deleterious effects of heat stress on feed intake, milk production, growth rate and reproduction are less in *B. indicus* than in *B. taurus* breeds (Gaughan *et al.*, 2012; Hansen, 2004). Owing to their long time adaptation with tropical climates, zebu breeds (*B. indicus*) of cattle are better able to regulate body temperature in response to heat stress than European breeds (*B. taurus*) (Beatty *et al.*, 2006; Gaughan *et al.*, 1999).

Body temperatures that exceed normal values are not ideal, and cows have been shown to decrease their feed intake and heat exchange capacity accordingly (Gorniak *et al.*, 2014). As a result, this leads to lower milk production and reproductive indices, as well as increased costs for the dairy industry in the summer months (Gantner *et al.*, 2011).

Conclusions

The fluctuations in physiological responses, and behavioural changes during heat stress are an effort to maintain normal homeostasis of the body and can be used as an index for assessing the adaptation capacity of cattle to changing climate that helps in the acclimatization process of animals during stressful period and can be used to assess the impact of thermal and CO₂ stress in ruminants.

With signs of climate change clearly visible everywhere, conservation of native breeds that are hardy and better suited to withstand high temperatures has been gaining ground. Genomic introgression from highly productive population to highly adapted population also increases climatic resilience of animals. However, genetics alone cannot counter climate change and human intervention for physical modification of the environment and improvement in nutritional management practices would be additionally required. Custom designed shelters system and feed supplementation both in feed and fodder can significantly improve the ability to withstand heat stress.

Keywords: Cattle, Adaptation, Breeding strategies, Milk Production, HSP90

Impact of biochar application on growth parameters of yellow stem borer *Scirpophaga incertulas* (Walker) under pot condition**Mahantesh Shreeshail Tonne¹, Sujay Hurali², Annamalai, M³, Sreenivas A. G¹, Badariprasad, P. R³, Masthan Reddy, B. G⁴.**¹College of Agriculture, UAS, Raichur, Karnataka, India - 584 104²AICRIP- Rice, Agricultural Research Station, Gangavathi, Koppal, Karnataka, India - 583 227³ICAR-National Rice Research Institute, Cuttack, Odisha, India - 753 006⁴College of Agriculture, Gangavathi, Koppal, Karnataka, India - 583 227**Purpose**

Among the rice insect pests, yellow stem borer (YSB), *Scirpophaga incertulas* (Walker) is predominant, monophagous and most destructive pest of paddy because of its ubiquitous distribution and chronic pattern of infestation and yield loss due to YSB was 87.66 per cent, if not taken any control measures (Pallavi *et al.*, 2017). Exploring the alternative management practice which is organic in origin is most encouraged. In this context one such alternative found is biochar. Biochar is a product obtained by pyrolysis of organic materials such as wood and agricultural waste in the absence of air in pit or trench at the temperature of 400-600 °C and also considered as one of the necessary nutrients for the plant growth and synthesis of biochemical compounds. Furthermore, biochar amendment to soils can have a negative effect on herbivory by sap-feeding insects (Elad *et al.*, 2010) of rice and biochar application has shown to enhance silicon (Si) uptake by plants and enhance induced defense responses in the plant (Chen *et al.*, 2019). But there are less studies focusing specifically on chewing insect pests affected by the biochar application to soil. Keeping all these factors in view, the present investigation was undertaken to ascertain the effect of biochar amendment on growth parameters of yellow stem borer under pot condition.

Materials and Methods

The present investigation was carried out at Agricultural Research Station (ARS), Gangavathi, Koppal district, Karnataka during 2020-21. The commercially available biochar was purchased from the Pointec pens and Energy Pvt. Ltd Mundargi. The soil used in the experiment was collected from fallow paddy field in ARS, Gangavathi. The soil was air dried and then filtered with 20 mm mesh sieve and carried out soil test.

The paddy seeds of TN-1 variety were sown in Entomology nursery block and later it was applied with recommended dose of fertilizers. Then 25 to 30 days old seedlings were transplanted in the plastic pots at the rate of three seedlings per hill in each pot. Before transplanting well-puddled soil mixed with different concentration of biochar and such pots were used in the experiments. To know the effect of different concentration of biochar *viz.*, 0 (control), 2, 4, 6, 8 and 10 per cent on *S. incertulas* mediated through paddy crop. Observation was taken on insect growth parameters *viz.*, fecundity rate, larval mortality, larval development time and stem tunnel length was observed. The data obtained in the experiment under current investigation for various parameters such as growth parameters of YSB was analyzed by calculating mean and standard deviation.

Results and Discussion

The larval developmental period of yellow stem borer was significantly affected among the different treatments amended with different concentration of biochar (Table 1). The larval development period was longer in T₄ (32.47 ± 0.99 days) followed by T₃ (30.00 ± 1.05 days). The larval developmental period in treatment, T₂ (28.00 ± 0.56 days) was on par with T₅ (27.98 ± 0.58 days) and which were statistically superior over T₇ (27.58 ± 0.54 days), T₆ (27.57 ± 0.57 days) and T₁ (26.60 ± 0.55 days). The mean fecundity ranged from 157.74 ± 0.82 eggs in the treatment, T₄ (8 % biochar) to 160.3 ± 1.25 eggs in control and the average fecundity of all the treatments were

statistically on par with each other. Similarly, larval feeding in terms of tunnel length measured at 60 DAT was computed and noticed the minimum tunnel length in T₄ (6.03 cm) followed by T₃ (8.04 cm) which was on par with All the biochar-based treatments tested were superior to the control which clearly indicated that biochar was definitely responsible for lower feeding rate in various treatments and the control treatment.

The present experimental results are identical with results of Chen *et al.* (2019) and Hou *et al.* (2015) who reported that the biochar amendment prolonged the larval development of leaf folder and delayed the nymphal development time of BPH and also found that number of eggs laid per female during her life time (fecundity) did not differ between biochar treatment levels. Parallely, our results are in contrary with the outcome of Hou *et al.* (2017) and Fu *et al.* (2018) who reported that biochar amendment decreased lifetime fecundity of *N. lugens* and *L. striatellus*. Hou and Han (2010) noticed that Silicon addition significantly prolonged larval development of *Chilo suppressalis*. The present results are alike with the reports of Rath and Seema (2017) who recorded the lowest tunnel length of 5.23 cm and highest tunnel length of 13.33 cm in silicon treated and non-silicon treated plants, respectively.

Conclusion: Under pot condition, the longer larval period (32.47 ± 0.99 days), highest larval mortality (33.33 %) and minimum tunnel length (6.03 cm) was observed in the treatment applied with 8 per cent biochar which was superior over all other treatments applied with different concentrations of biochar. However, the fecundity was statistically non-significant between the treatment having different levels of biochar application. Biochar concentration of 8 per cent was significantly superior compared to all other concentrations. Thus, the amendment of 8 per cent biochar will be an eco-friendly management strategy against rice yellow stem borer.

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Table 1. Effect of biochar amendment on growth parameters of yellow stem borer under pot condition

Treatments	Larval developmental period (Mean \pm SD) *	Fecundity (Mean \pm SD) **	Larval mortality (%)	Stem tunnelling length (cm)
T ₁ : 2 % Biochar	27.60 \pm 0.55 ^d	158.97 \pm 0.74 ^a	0.00 (0.00) ^d	12.20 (3.56) ^b
T ₂ : 4 % Biochar	28.00 \pm 0.56 ^c	158.18 \pm 1.10 ^a	10.74 (19.13) ^c	11.15 (3.41) ^b
T ₃ : 6 % Biochar	30.00 \pm 1.05 ^b	158.46 \pm 0.52 ^a	25.00 (30.00) ^b	8.04 (2.92) ^b
T ₄ : 8 % Biochar	32.47 \pm 0.99 ^a	157.74 \pm 0.82 ^a	33.33 (35.26) ^a	6.03 (2.56) ^a
T ₅ : 10 % Biochar	27.98 \pm 0.58 ^c	158.62 \pm 0.52 ^a	10.74 (19.13) ^c	11.15 (3.41) ^b
T ₆ : Chlorpyrifos 10 GR	27.57 \pm 0.57 ^d	158.90 \pm 0.88 ^a	10.37 (18.79) ^c	12.72 (3.64) ^b
T ₇ : Untreated control	27.58 \pm 0.54 ^d	160.33 \pm 1.25 ^a	0.00 (0.00) ^d	12.72 (3.64) ^b
S. Em (\pm)	0.11	0.40	0.24	0.2
CD (p=0.01)	0.46	1.69	1.02	0.83

N = 10 * - days ** - Numbers

Values in parenthesis are $\sqrt{x+0.5}$ and arcsine transformed

Means followed by same alphabet in columns did not differ significantly (p=0.01) by DM

Seasonal Dynamics Of Major Insect-Pests In High Density Planting System (Hdps) Of Cotton

Dd Patait*, As Jadhav, Ss Dhurgude And Pb Jadhav

Cotton Research Scheme Vasantrya Naik Marathwada Krishi Vidyapeeth, Parbhani- 431401

Purpose

Nowadays new trend of high density planting system in cotton has been followed by farmers so as to increase per acre productivity of cotton. Also the pest incidence was changing by previous years. Hence, the present investigations were carried out to study seasonal incidence of major insect pests of cotton in high density of cotton ecosystem and their natural enemies during *Kharif* 2021-22 at Cotton Research Scheme, Vasantrya Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra.

Methods

In this experiment plots were laid for NH 615 (HDPS) cotton variety. Randomly ten plants were selected from each plot for recording observations at weekly interval basis. Observations were recorded on incidence of major sucking pests *viz.*, aphids, jassid, thrips and whiteflies on three leaves per plant. Population of natural enemies of the pests were recorded from whole plant. Damage due to bollworms in fruiting bodies and locule were also recorded. No plant protection measures were adopted for management of pests.

Results

The present findings showed that during the growing season, highest population of aphid (36.00/three leaves) was observed during 34th MW while highest incidence of jassids (11.20/three leaves) was observed during 39th MW. Thrips Peak population (26.72/three leaves) was observed during 41st MW. The highest incidence of white fly (25.76/three leaves) was observed in 41st MW. The highest percent fruiting body damage (56.29) was recorded during 50th MW. During later

stage of the crop green 17 bolls/20 green bolls were found damaged due to pink bollworm with 17 larvae on 160 DAS. The locule damage was observed 35.86 % at 1st picking and 31.43 % at 2nd picking.

Highest population of LBB (2.20/Plant) was recorded during 41st MW. While maximum number of chrysopa (2.00/plant) was recorded during 37th MW.

CONCLUSION:

In seasonal dynamics, the peak populations of jassid was in September, whereas, thrips and whitefly population were in October and aphid population in August month. Fruiting body damage and pink bollworm damage were highest in December month. Population natural enemies were in proportion with sucking pest population throughout the season.

KEYWORDS: Cotton, HDPS cotton, sucking pests, fruiting body damage, pink bollworm, natural enemies.

Effect Of Chemicals And Biomix On Root, Shoot Growth AndSurvivals Of Cuttings In Dragon Fruit (*Hylocereus undatus*)

RV Nainwad and MB Patil

Fruit Research Station, Aurangabad-431001. Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani.(M.S.)

Purpose

Dragon fruit is member of the family Cactaceae and perennial, climbing cactus with triangular green stem. It is commonly called Pitaya, Strawberry pear, Night-blooming cereus, Queen of night, Honorable queen, *Cereus triangularis*, Kamlam and Jesus in the cradle and Belle of the night. The average composition of Drogon fruit is water (89.4 gm), protein (0.5 gm), fat (0.1 gm), crude fiber (0.3 gm), ash (0.5 gm), calcium (6 mg), phosphorus (19 mg), iron (0.4mg), niacin (0.2 mg), Ascorbic acid (25 mg), Brix value (11-19), P^H value (4.7-5.1) Gunasena *et al.*, (2006) ^[1]. It is usually propagated by seed or cuttings. Seed propagation method is very simple, but seeds are not true to type due to cross pollination and also seeds are to be stored for about 28 days without losing viability. Whereas, vegetative propagation is the easiest and cheapest method of propagating dragon fruit particularly by cutting. Plant established from cutting start flowering after one to two years of planting. Cuttings can be obtained throughout the year. Therefore large number of the plantlets with healthy shoots and root system can be produced to meet the demand of increasing commercial cultivation through vegetative propagation method. Dragon fruit has shallow root system hence in water logging soil root damage percentage is more in early growth stages. The reports on an investigation on the propagation of dragon fruit from cuttings and the use of growth regulators for better root growth success and survival are scanty. Therefore, the study was undertaken to propagate Dragon fruit using different chemicals, biomix, for rapid multiplication.

Materials And Method

The experiment was carried out at Department of Horticulture, College of Agriculture, Badnapur during the year 2020- 2021. The experiment was laid out in randomized block design with ten treatments replicated thrice. The details of treatment are T₁ - IBA @ 5000 ppm, T₂ - IBA @ 6000 ppm, T₃ - IBA @ 7000 ppm, T₄- PHB @ 500 ppm, T₅- PHB @ 750 ppm, T₆- PHB @ 1000 ppm, T₇ - Biomix @ 0.5%, T₈ - Biomix @ 1.0%, T₉ - Biomix @ 1.5%, T₁₀- Control (No Treatment). Planting of Dragon fruit cuttings in polythene bags of size (4" × 6"). The polythene bags were punctured to improve the drainage and filled with a garden mixture prepared by mixing one part of the soil, one part of sand, one part of well-rotted FYM (1:1:1 proportion of soil, sand

and FYM). The cuttings of Dragon fruit (*Hylocereus undatus*) used for this research were selected from 3 years old mother plant.

Cutting will be selected from one year old shoot with 10 to 15 cm length and 4-5 nodes. Treatment wise solutions of IBA, PHB and Biomix were prepared. The required quantities of chemicals were weighed on the chemical balance. The weighed quantity of chemical powder was dissolved in 5 ml of ethyl alcohol (50%) then the required quantity of distilled water was added to make the solutions of desired concentrations. The application of these treatments was done. Observations were recorded for number of primary roots, average root length, volume of root, rooting percentage, survival percentage and minimum mortality percentage. The data was analyzed statistically as per method suggested by Panse and Sukhatme (1985) [3].

Results

In present experimentation, Minimum number of days required to initiate first shoot (14.83), maximum number of shoots per cutting at 30 days (1.00), at 60 days (1.80) and at 90 days (2.47), maximum length of shoots per cutting at 30 days (2.65 cm), at 60 days (8.40 cm), and at 90 days (17.54 cm), maximum fresh weight of shoot (56.67 g), maximum dry weight of shoot (11.33 g), maximum shooting percentage (95.00%) maximum number of primary roots (10.47), average root length (12.50 cm), volume of root (1.98 ml), survival percentage (95.00%), minimum mortality percentage (5.00%) was noticed in treatment T₃ (IBA 7000 ppm). While minimum number of primary roots (5.60), average root length (1.63 cm), volume of root (1.35 ml), survival percentage (71.67%), maximum mortality percentage (28.33%) was recorded in treatment T₁₀ (control). Auxins are known to induce stimulus for regeneration of root by promotion of hydrolysis, mobilization in the region of root formation. Similar findings were reported by Siddiqui *et al.* 2018 in dragon fruit.

CONCLUSION

From the experiment, it may be concluded that the application of IBA @ 7000 ppm by quick dip method was found superior in root, shoot growth and survival of dragon fruit.

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A Socio-Economic Analysis of Organic Farming in India

Kushagra Prasad And Vinod Kumari

Department of Sociology, Chaudhary Charan Singh Haryana Agriculture University, Hisar, Haryana 125004

Purpose

The decades post the realisation of the profits made by the Green Revolution in the Northern part of the country had unintended issues ridding with it. With the increase in productivity leading to an increment in farm incomes; the status of farmers did upshoot which further strengthened their overall standing in society. Although, the gains garnered by the Green Revolution were seen later on with the increased instances of “over criminalisation” and fertilisation of the soil having severe health impacts. The addition to the income of the farmers and improving their social standing did come at a cost- the cost of economic viability, ecological stagnation and most importantly personal health issues of the farmers.

Objectives

Assessing the extent of Organic Farming in India

Reviewing the Knowledge-Adoption Levels and Socio-Economic Impact of Organic Farming in India

Methodology

In-depth analysis of the secondary sources such as review papers, research articles, government publications and case studies at the pan-India level.

Organic Farming in India: Talking Numbers

India holds a relatively unique position in the globe when it comes down to the essentials of Organic Farming. As per the Research Institute of Organic Agriculture FiBL and IFOAM-Organics International report in 2021, it was reported that India is home to around 30 per cent of the total organic producers in the world with as many as 28 lakh farmers, 1700 processors and 800 traders making up the entire organic ecosystem chain in the country which is growing at a burgeoning rate.

According to the latest data released through National Programme for Organic Production (NPOP) by the Agricultural and Processed Food Products Export Development Authority (APEDA), there has been a marked increase in the total area under the organic certification process. In 2021-22, the total area under the organic certification process was 9119865.91 hectares which is an astonishing increment from 4339184 hectares in 2020-21.

Review And Results

The adoption of Organic farming in the districts of Sonapat, Karnal, Kaithal and Kurukshetra concerning Basmati rice was found high. The major reasons revolved around assured prices in advance to the farmers and post-harvest facilities by the contractors (Kumar *et al.*, 2013). The results stemming from the state of Haryana were in consonance with the knowledge levels of farmers as reported in the state of Tamil Nadu (Jaganathan *et al.*, 2012) and Madhya Pradesh (Kumar *et al.*, 2014). Although, as far as the Northern States were concerned, the lower adoption was due to way higher yields due to the drastic increase in chemical inputs (Reddy, 2010).

The farm income from agricultural activities increased by more than 15 per cent for the organic growers with income from other sources showing an upward trend as well (Hoop *et al.*, 2018). In the ground-breaking work done in the southern state of Kerala on the impact of Fair-Trade Alliance Kerala (FTAK) and organic farming, it was gauged that farmers were able to earn 20 to 50 per cent more for the commodities grown on the principles of organic farming. Also, it was further noted that the additional incomes were used by the farmers to buy better quality seeds, avail better health facilities and send their kids abroad (Karunakaran and Sadiq, 2019). To gauge the socio-economic impact of Organic Farming in the Sri Ganganagar district, it was noted that the net profit increased with the decrease in expenditure on chemical inputs and materials. The increase in net profit did boost farmers in the adjoining areas adopting Organic Farming Systems (Meena, 2010). The minimum inputs used in Organic farming and increased participation of women did point towards low-cost efficiency and women empowerment at large in Southern Rajasthan. Inorganic farming yield reduction was observed in the initial years of adoption, but later on, it takes a normal level. In the adjoining state of Maharashtra, on the analysis done on the Sugarcane crop, it was seen that the organic sugarcane gave 16 per cent higher profits which were utilised by farmers to access better health and education facilities for their family members and kids respectively (Kshirsagar, 2007). In the integrated studies done in the country of Bangladesh and West Bengal, it was observed that post the adoption of Organic Farming, the economic status of the farmers did increase. The remarkable results pointed out that the increase in food consumption increased by

22 per cent and the debt of the farmers was gone due to government intervention (Azam and Shaheen, 2018).

Conclusion

The government's response usually towards Organic Farming is positive and strengthens the farmers' position. A greater synergy between the farmers, farmer organisations and govt officials to tackle the nitty-gritty of Organic Farming is required. The data from NPOP and other government agencies suggest that organic farming is finally booming in the country. Adding to the assistance provided through various agencies, the spectre of organic farming is here to grow even further. The state of Madhya Pradesh providing fair market prices to organic farmers even in case of no demand has made farmers grittier in adopting organic farming. Organic Farming showing encouraging results as discussed before with added impetus on crop residue management, organic waste collection, and ecological viability has led to an overhaul of Indian Agriculture. Therefore, the time is not far away when we will be witnessing the Organic Revolution in the hooks and corners of the country and looking at the dawn of the OG (Organic Green) Revolution.

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Analysis on the Bilateral Trade of Natural Honey between India and Developed Countries

B. KEERTHIKA^{1*} and Dr. M. THILAGAVATHI²

¹ Department of Agricultural Economics, CARDS, TNAU, Coimbatore-641 003, India.

² Department of Agricultural Economics, CARDS, TNAU, Coimbatore-641 003, India.

Abstract

India is the top natural honey-producing country in the world with wide flora and fauna. The government has implemented several missions and schemes to boost production as well as the export of natural honey from India. Sweet Revolution was implemented to particularly enhance the scientific honey production in the country. As the honey export was increasing over the years from 2000 to 2021, the major destination was the USA which comes under the developed countries

listed by the World Bank. Hence, in this paper, the export trend analysis was done to show the major exporting destination from India and it was compared to the world export. The Compound Annual Growth (CGR) rate was estimated for 10 years from 2012-2021 for the developed nations as well as the total export to the world and it was found to be 12.77 percent and 13.86 percent per annum for the developed countries and the rest of the world in the export volume of honey. Hence government will enhance the export promotion policy to increase the export to other nations to avoid the concentration effect.

Keywords: Sweet revolution, CGR, Developed nation, Export trend analysis.

Introduction

The Indian government has approved a new two-year central sector program called "National Honey and Beekeeping Mission (NBHM)" to promote and develop holistically scientific beekeeping. According to the mission mode, the goal is to achieve the country's "Sweet Revolution" goal by creating a drive for capacity building and training, with a special focus on women, input support for promotion and production, the establishment of an Integrated Beekeeping Development Centre (IBDC), other infrastructure, digitization/online registration, etc., transformation, value-added, market support, etc., and R&D under three Small Missions (MM), MM-1 (production & production), MM-2 (post-harvest management of beekeeping/ beehive products, including collection, processing, storage, marketing, value addition, etc.) & MM-3 (Research & Technology generation for different Regions/ States/ Agro-Climatic and Socio-Economic conditions).

The Food Export Development Authority Agriculture (APEDA) has worked to stimulate exports by ensuring quality production and expanding markets to new countries in order to harness the potential of honey exports in line with Prime Minister a vision of a "sweet revolution" through the promotion of beekeeping and related activities. At the moment, India's natural honey exports are primarily reliant on one market, the United States, which accounts for more than 80% of total export turnover. We collaborate closely with state governments, farmers, and other value chain stakeholders. "To promote exports to other countries and regions such as the United Kingdom, the European Union, and Southeast Asia," said APEDA's president. India is also renegotiating the tariff structure imposed by many countries in order to increase honey exports. APEDA has assisted honey producers in gaining access to export markets and has received government support through a variety of programmes, including quality certification and laboratory testing. APEDA is collaborating with exporters to address issues such as higher shipping costs, limited container volumes during peak honey export season, and higher nuclear magnetic resonance testing costs, among others. Insufficient export incentives. In 2020-21, India exported 59,999 tonnes (MT) of natural honey valued at Rs 716 (US\$96.77 million), with the US accounting for 44,881 tonnes. The main markets for Indian honey are Saudi Arabia, the United Arab Emirates, Bangladesh, and Canada. In 1996-97, India began its first organised export. In 2020, global honey exports are expected to total 736,266.02 tonnes. In terms of honey production, India ranks eighth and ninth in the world, for honey production and exporting respectively. The production of honey was 1,721,000 tonnes worldwide in 2019. This includes honey from all nectar-producing plants, cultivated plants, wildflowers, and trees in the forest. One-half of the world's honey is produced in China, Turkey, Canada, Argentina, Iran, and the United States, which are also among the top producers. The majority of the nation's natural honey is produced in the Northeast and Maharashtra. Most of the honey produced in India is exported to other countries; the remaining portion is consumed domestically to a lesser extent. Exports of honey have a great deal of potential, particularly during the COVID-19 pandemic, as honey consumption has risen globally as a more

healthy alternative to sugar and an efficient immune booster. The government of India has approved the allocation of Rs 500 crores to the National Honey and Beekeeping Mission (NBHM) for three years (2020 to 2023). In February 2021, the mission was announced as part of the Atma Nirbhar Bharat initiative. To support the National Bee Board's (NBB) "Sweet Revolution" initiative, NBHM seeks to advance scientific beekeeping throughout the nation. 170 crores of rupees were allotted for the Mission Mini. The objective is to increase exports, enhance honey quality and yield, and develop domestic bee honeycombs. (PIB, 2022). To estimate the trend and instability in the trade of natural honey from India and to analyse the direction of the trade, this study was carried out with these considerations in mind.

Review

India is the largest producer and exporter of honey playing important role in world production and trade (Agarwal, 2014) where the export has increased to 109.80 percent over last year (2020) and now India is exporting to 62 countries (Sharma, 2012; Jamwal et al, 2021). García (2018) identified that global honey consumption has increased due to an increase in population and people moving towards the consumption of natural foods. According to Kalita et al (2007), India has been able to gain recognition as one of the highest exporters of natural honey. Shree et al (2017) studied the trade pattern of natural honey export from India using Markov chain analysis and found that the US, Saudi Arabia, the UAE and the Yemen Republic as the top importing countries. Singh (2021) explored the trade pattern and export and import of natural honey from India, in which he concluded that India is the net exporter of honey and the majority of imports are from the US. Shree et.al (2017) employed Markov chain analysis to explore the trade pattern of honey from India and found that UAE retained 100 percent of the previous year's market share from India. Instability in the production and export of natural honey was analyzed by Gaware et al (2018) for the period from 1997 to 2016 and found that there was an increase in the instability of export as good production.

Data and Methodology

As the export of natural honey was concentrated only in developed countries like USA, UK, Germany and others (refer to the world bank classification for developed countries list), analysing the trade pattern of these countries will enable India to further deepen the trade to these countries. The data for this study was gathered from a variety of secondary sources. Time series data on natural honey export and imports (in quantity and value terms) for the developed countries (World Bank Classification) and India, production of Natural honey were gathered from the Food and Agricultural Organization of the United Nations, FAO trade statistics, FAO commodity Review and Outlook, APEDA, Trade Map and National Bee Board for a period of ten years (2012–2021). Compound Growth Rate: Any variable's growth reveals its past performance and is widely used in economic research to determine a variable's trend over time. CGR was calculated to identify the trend in the production and export of natural honey from India using the exponential form as follows: $\ln Y_t = \ln Y_0 + t \ln (1+r)$. Here, Y_t is the variable for which growth is calculated, r is the compound growth rate and \ln is the natural logarithm. Now, let $\ln Y_0 = \beta_1$ and $\ln (1+r) = \beta_2$. Therefore, the above equation becomes, $\ln Y_t = \beta_1 + \beta_2 t$. Now, β_1 and β_2 are estimated by Ordinary Least Square (OLS) method and the CAGR is given by, $R = (\text{antilog } \beta_2 - 1) \times 100$

$$Y = b_0 + b_1 t$$

$$\ln(Y) = \ln(b_0) + \ln(b_1) t$$

Where,

Y = Values of Production ('000 MT) and Export (MT/yr)

t = time variable.

b_0 and b_1 = coefficients to be estimated and \ln is the natural log.

$$CAGR = (\text{Antilog of } b - 1) \times 100$$

Apart from the CGR, some basic percentage and average analyses were also done to view the overall trade performance of India with the developed countries.

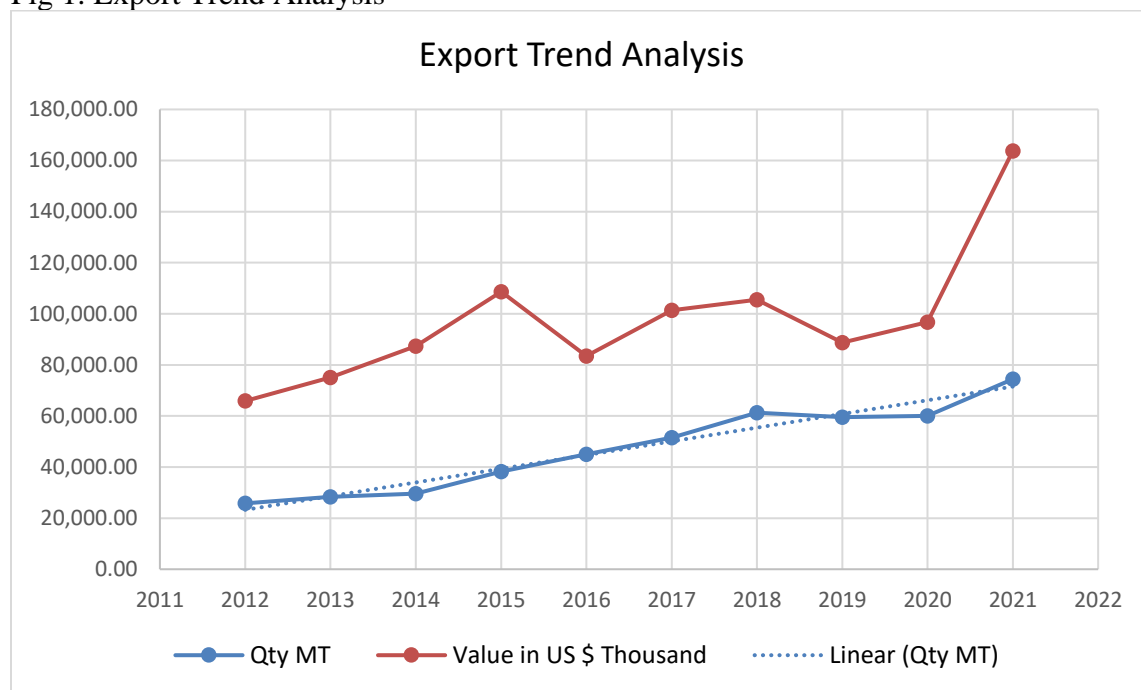
Result and Discussion

The compound annual growth rate was calculated for twenty years from 2012 to 2021. For a better understanding of ten years of data on export quantity (in MT) and production (in ‘000 MT) of natural honey in India, the overall export was calculated and it was found to be 12.77 percent and significant at 1 percent at export in terms of quantity (MT) and for the value of export, the CGR was found to be 6.35 percent and also highly significant.

From Fig.1 it is shown that the overall export of natural honey from India was found to be increasing from 2012 to 2021. The quantity of export was 25,780 MT in 2012 to 74,413 MT in the year 2021. And also the export value increased from US ‘000\$ 65,862 in 2012 to US ‘000\$ 1,65,750 in the year 2021.

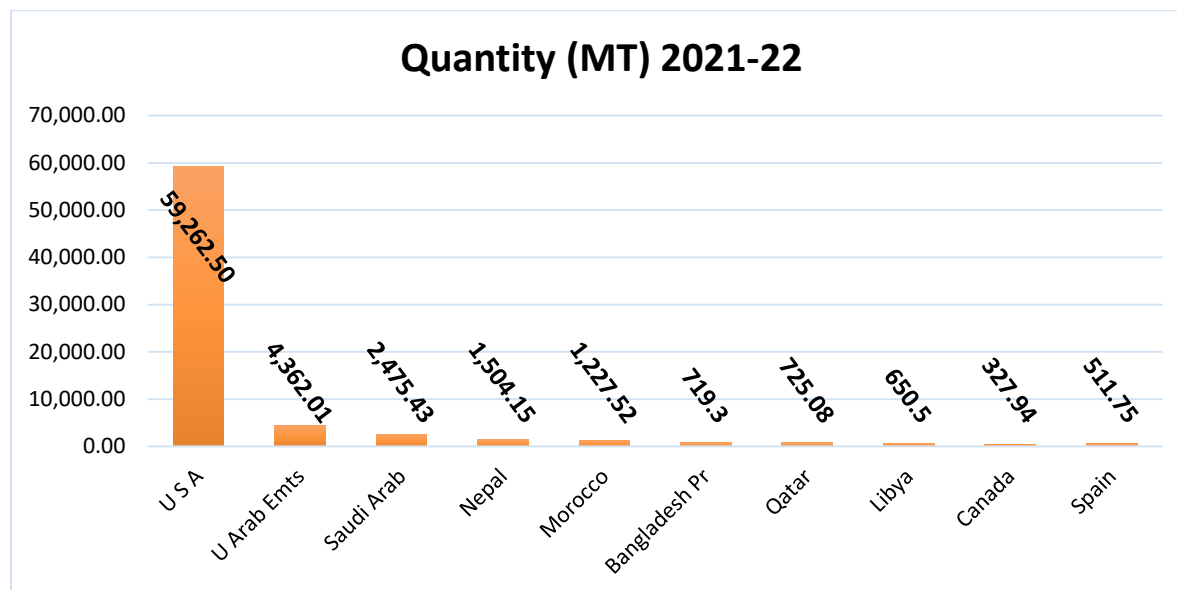
Comparing the overall CGR of the export of natural honey from India to the world it was found that the export volume has a CGR of 13.86 percent per annum and the export value has a CGR of 14.68 percent per annum.

Fig 1. Export Trend Analysis



Source: Author’s own calculation

Fig.2 Top 10 export markets of Indian Natural Honey



Source: APEDA

The major destination for India's natural honey was the USA, UAE, Saudi Arab, Nepal, Morocco, Bangladesh Pr, Qatar, Libya, Canada and Spain. But the 90% of the export market was to the United State of America with 59,262 MT followed by 4,362 MT by UAE, 2,475 MT by Saudi Arabia, 1,504 MT by Nepal, 1,227 MT by Morocco, 725 MT by Qatar, 719 MT by Bangladesh, 650 MT by Libya, 327 MT by Canada and 511 MT by Spain.

Table.1 Developed countries percentage share of Imports from India

Year	India's export to Developed Countries (Qty MT)	India's export to the world (QTY MT)	% of export to Developed Countries
2012	21274	24515	86.78
2013	25606	30099	85.07
2014	22174	26976	82.20
2015	36851	40771	90.39
2016	30859	35793	86.22
2017	46243	52980	87.28
2018	49995	58231	85.86
2019	55963	65351	85.63
2020	43064	54834	78.54
2021	56783	70514	80.53

Source: Author's own calculation

India's export to the developed countries was 21,274 MT in the year 2012 to the 56,783 MT in 2021, whereas India exported 24,515 MT to the world in 2012 and it was 70,514 MT in 2021. While calculating the percentage of export to developed countries revealed that the overall export was higher to the developed nations to the world with 86.78 percent in 2012 and in 2021 the percentage of export to the developed countries reduced to 80.53 percent.

Conclusion and Policy Measures

The CGR results showed that there is an increasing growth in the export of volume and export value for the both world as well as to the developed nations. The government of India introduced many schemes and missions to increase the production of natural honey in India as well as to increase the export of natural honey to differentiated markets. The analysis of bilateral trade between India and developed countries showed that an average of 85 percent of the total export from India was destined for developed nations. In this regard, the government has to implement many schemes and negotiate the tariff rates to increase export to developed nations.

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Estimation Of Biomass And Carbon Stock Potential Of *Shorea robusta* For Climate Change Mitigation In Uttarakhand, India

Shweta Semwal, Himshikha Gusain*, J.S.Butola, Dharmendra Shah, A.K. Negi

*Department of Forestry and Natural Resource, HNBGU (A Central University), Srinagar Garhwal, Uttarakhand, 246174

Introduction

Carbon sequestration is considered a leading process for reducing carbon dioxide (CO₂) emissions under changing climatic scenario. Trees are known to sequester the atmospheric carbon into long lived wood biomass and soil pool. Forests play an important role in regional and global carbon (C) cycles as they store significant amounts of carbon in vegetation and exchange carbon with the atmosphere through photosynthesis and respiration and are source of atmospheric carbon when they are disturbed by human or natural causes, become atmospheric sinks during disturbance, and can be managed to sequester or conserve significant quantities of carbon on the land (Sharma *et al.*, 2011). To assess the impact of deforestation and re-growth or regeneration rates on the global carbon cycle, it is necessary to know the stocks of carbon as biomass per unit area for different forest types. The above ground biomass and below ground root biomass both need to be measured to enable better calculations of total forest carbon (Hamburg, 2000),

additionally it gives useful details on the structural and functional characteristics of forest ecosystems.

Objective: This study was done to investigate tree basal area, tree volume, total tree biomass pattern and carbon stock in *Shorea robusta* dominated forest at three different altitudinal zone of Duggada forest range in Shivalik foothills, Uttarakhand, India. Efforts were also made to assess carbon sequestration in soil under these locations.

Methodology

Data were collected from the field survey that includes measurement of tree parameters (tree height, tree girth) For the field measurement, 30 sample plots sizes of 10m×10m, 10 sample plots at each altitudinal range were selected randomly. For collecting soil samples two sub-plots of size 1m×1m were laid down, one at North-East corner and another in the South-West corner of the main sample plot (30x30 cm). Form factor was calculated using formula given by (Pressler, 1895 and Bitterlich, 1984). Wood density for the estimation of above ground biomass used is 0.72 as given by FSI, (1996) and biomass expansion factor used is 3.4 as given in IPCC (2003).

Results

As per the analysis of the field data (tree parameters i.e., tree girth, tree height) collected during the course of field survey from the selected experimental sites, the maximum total tree carbon stock ($28.82 \pm 4.28 \text{ t ha}^{-1}$), above ground biomass (AGB) as $45.74 \pm 6.79 \text{ t ha}^{-1}$ and below ground biomass (BGB) $11.89 \pm 1.76 \text{ t ha}^{-1}$, mean tree basal area ($2.03 \pm 0.23 \text{ m}^2 \text{ ha}^{-1}$) and total tree volume as $18.68 \pm 2.77 \text{ m}^3 \text{ ha}^{-1}$ (ranging from 16.75 to 18.68 $\text{m}^3 \text{ ha}^{-1}$) were reported in lower elevations (400-700m asl) with a decreasing trend towards higher side. A reduction in studied parametric values was observed as the elevation ranged up. Total volume of trees ($r = 0.99$, $p = 0.04$), AGB and tree carbon stock ($r = 0.99$, $p = 0.03$), BGB ($r = 0.99$, $p = 0.04$) and tree basal area ($r = 0.99$, $p = 0.13$) were recorded significantly decreasing (strong negative correlation) with altitude. On physical properties of soil, Soil carbon stock and Soil organic carbon (SOC) increased with altitude, values ranging from 33.33 t ha^{-1} to 40.96 t ha^{-1} , showing strong positive correlation with altitude ($r = 0.97$, $p = 0.17$; and $r = 0.84$, $p = 0.37$ respectively). Highest moisture content percentage was recorded as $2.19 \pm 0.26\%$ at 1001-1300m and Soil bulk density at 701-1000 m as $0.97 \pm 0.03 \text{ g cm}^{-3}$ (ranged between 0.86 to 0.97 g cm^{-3}), which showed weak positive correlation with altitude ($r = 0.08$, $p = 0.95$) (Table 1).

Table 1: Average total AGB, BGB and Total Tree Carbon Stock of *Shorea robusta* in Sal forest, Duggada range, Uttarakhand

Site/ range(m)	Altitude	Basal Area ($\text{m}^2 \text{ ha}^{-1}$)	volume ($\text{m}^3 \text{ ha}^{-1}$)	AGB (t ha^{-1})	BGB (t ha^{-1})	Total Carbon Stock (t ha^{-1})
Site 1 (400-700)		20.27 ± 2.26	186.84 ± 27.73	457.38 ± 67.88	118.92 ± 17.65	288.15 ± 42.77
Site 2 (700-1000)		11.47 ± 2.10	108.58 ± 23.57	265.82 ± 58.15	69.11 ± 15.12	167.47 ± 36.63
Site 3 (1000-1300)		7.37 ± 0.00	44.23 ± 6.51	105.59 ± 17.17	28.14 ± 4.15	66.77 ± 9.77
r Value		0.99	0.99	0.99	0.99	0.99
p Value		0.13	0.04*	0.03*	0.04*	0.03*

r = Correlation Coefficient, p Value = Significance levels, *Correlation is significant if $p \leq 0.05$.

Conclusion

The results of the study indicated that above-ground biomass and below-ground biomass as well decreases with increasing altitude which led to highest total tree carbon from all three locations. Soil organic carbon % and SOC showed strong positive correlation with altitude. The results also shows that the species density is larger at lower altitude when compared to the higher altitude because of the silvicultural requirements of Sal. The results further indicated that the total soil carbon stock increased with increasing altitudinal range. Findings proved that *Shorea robusta* contains immense biomass and carbon stock in the lower elevations, contributing to sequester more carbon from the environment. However, a reduction in AGB and BGB is possibly due to topographic and anthropogenic factors limiting growth at higher sides. Considering its vital role in mitigating climate change through carbon sequestration potential, the research recommends application of site, specific management and silvicultural regime for Sal forest in the region.

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Inequalities in Distribution of Agricultural Resources Across Farm Class Nandini Saha^a, Dr. Pramod Kumar^a, Omprakash Naik^{a*}

a: ICAR-Indian Agricultural Research Institute, New Delhi

b: International Water Management Institute

Purpose

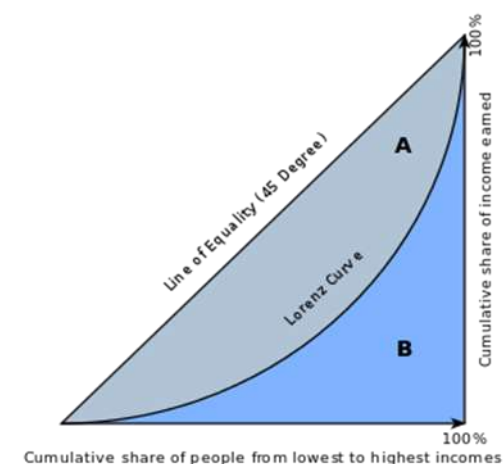
India being primarily an agrarian country, Agriculture serves as the major source of livelihood for most of the Indian population. The production and yield arising out of agriculture heavily depend upon the use of resources. Land, Labour, Seed, Fertilizer, Plant Protection Chemicals, Agricultural Tools & Implements, Credit etc. are the major input resources that aids in production. But the major problem is the inequitable distribution of these input resources among the farm classes which ultimately hampers production. Not only the production, the purchasing power of the farmers also indirectly depends upon it. According to World Bank Report, 2008, for agricultural household, capacity to buy is dependent upon the production which is in turn dependent upon the use of resource. Access to productive resources such as land, water, and other inputs are keys to higher level of agricultural incomes and poverty alleviation (IHDS, 2003). According to OECD Report, 2014, Rising asset inequality by 1 percentage point is estimated to knock off a country's growth by 10 percentage point Therefore, its of key importance to address the problem of input inequality, & formulate new policy measures aiming at reducing the inequality.

Methods

There are several measures of inequality, however Gini Coefficient is the most widely used method of measuring inequality. It was developed by Italian Statistician Corrado Gini in 1912.

Calculation of Gini Coefficient is done using Lorenz Curve, a cumulative frequency curve which shows cumulative percentage of the variable on the vertical axis and cumulative percentage of household or population on the horizontal axis.

Gini Coefficient ranges from 0-1, 0 means perfect equality, 1 means perfect inequality.



The Gini Coefficient is calculated by $A/(A+B)$, A, B area been shown on the graph .

When A is 0, coefficient become 0, when B is 0, coefficient become 1 indicating perfect equality & perfect inequality respectively.

Formally let x_i be a point on X axis & y_i be a point on Y axis, then

$$Gini = 1 - \sum_{i=1}^N (x_i - x_{i-1}) (y_i + y_{i-1})$$

Results

Calculation of Gini Coefficient showed that inequality in land distribution, fertilizer use, and irrigated area is highest in Kerala. However, in terms of access to institutional credit, inequality is highest in Uttar Pradesh. Apart from that, change in inequality (with respect to Input Survey 2001-02) has also been calculated.

When compared with 2001-02, In Land Distribution, inequality has risen for all the 13 states except Andhra Pradesh & Madhya Pradesh, for fertilizer use, inequality has risen for 10 out of 15 states. For irrigation, every state has shown increasing inequality and lastly for Credit, inequality has decreased for only 3 states i.e., Himachal Pradesh, Madhya Pradesh & Uttar Pradesh.

Conclusions

In this study, detailed analysis on accessibility of different farm classes to different inputs in 15 major states has been done. Four Major inputs i.e., Land, Irrigation, Fertilizer and Institutional Credit has been considered for the study.

As per the latest input survey (Input Survey 2016-17) average area per holding ranges as low as 0.18 ha in Kerala to highest in Punjab 3.58 ha, chemical fertilizer use it is lowest in Kerala with only 18% holding using Chemical fertilizer and highest in Haryana with 98% of the holding using chemical fertilizer, both gross and Net irrigated area is highest in Uttar Pradesh and, the percentage of population who has taken institutional credit is highest in Punjab and in lowest in Assam.

Except Credit, for other 3 input resources, the inequality was found highest in Kerala, and for Credit, inequality is highest in Uttar Pradesh.

For all the four inputs, inequality has increased in most of the states, which is a concern. Government has introduced many interventions from time to time to address this problem. But still the problem prevails. So, new policies regarding input resources must aim at reducing inequalities in input distribution & previous policies should be rectified.

Keywords: Land, Fertilizer, Irrigation, Institutional Credit, Inequality

Awareness level of Farmers about Global warming effect on Agricultural sectors in Navsari District of South Gujarat

N.M. Chauhan and Neha Parikh

Director of Extension Education and Education, NAU, Navsari-366 450, Gujarat. India.

Abstract

Now-a-days, global warming is an important factor impacting agricultural sector and most importantly impacting agricultural production. Decline in agricultural production negatively affect the livelihood of farming community and ultimately affect their standard of living. An

understanding about how global warming affects production helps farmers to use suitable techniques to cope up with the situation or helps to mitigate the effects of global warming. Knowledge about global warming and how it affects the agriculture help farmers to use appropriate practices and technology that is suitable in changing weather condition.

The study was conducted in Navsari district of South Gujarat during the year 2020-21. Results of the investigation shown that majority of the respondents belonged to middle age category, having medium level of farming experience, with small size of land holding, with up to high school level of education, having small size of nuclear family, engage in farming alone and had membership in one organization. They used tube well as a source of irrigation, having Rs. 1,00,001 to 1,50,00 annual income, medium level of mass media exposure, medium level of innovativeness, medium level of socio-economic status, medium level of awareness about crop insurance and medium level of extension contact. They also had medium level of risk orientation, medium level of scientific orientation, medium level of economic motivation and medium level of general knowledge about global warming.

Results shown that majority of the respondents had medium knowledge level about global warming effect on agricultural sector. In correlation analysis, age and size of family was negative and non-significantly associated with knowledge level of farmers about global warming effect on agricultural sector while, land holding, type of family and annual income was positive and non-significantly associated with knowledge level of farmers about global warming effect on agricultural sector. Whereas, farming experience, occupation, social participation, irrigation facilities, mass media exposure, innovativeness, crop insurance, risk orientation, scientific orientation, and economic motivation was positive and significantly associated with knowledge level of farmers about global warming effect on agricultural sector. Education, socio-economic status, extension contact, and general knowledge of farmers about global warming effect on agricultural sector were positive and highly significant with knowledge level of farmers about global warming effect on agricultural sector.

Keywords: Global warming, Green House Gases, Awareness level, Agricultural sector, livelihood and standard of living.

Introduction

‘Global warming is defined as an increase in the average temperature of the Earth's atmosphere, especially a sustained increase great enough to cause changes in the global climate’. The energy from the Sun is absorbed by the Earth's surface and then radiated back into space. However, some of this energy is then absorbed by some gases in the atmosphere. These gases then radiate some of this absorbed energy back towards the surface of the Earth. This greenhouse effect is what warms the Earth above the freezing point and the gases resulted the warming called greenhouse gases (GHGs). The term global warming is synonymous with Enhanced green house effect, implying an increase in the amount of green house gases (GHGs) in the earth's atmosphere. These greenhouse gases are carbon dioxide (81 per cent), methane (10 per cent), nitrous oxide (7 per cent) and fluorinated gases (3 per cent). (Anonymous, 2018). Increase in temperature causes changes in general circulation of world's climate. The agriculture is highly sensitive to surrounding atmosphere. Total annual loss in world production of agriculture is mainly due to adverse weather conditions.

The global warming causes the changes in long term pattern of weather. Here, the term ‘weather’ means short-term or daily changes in precipitation, temperature, wind of a region. In long term, global warming affect agriculture as decrease in production and productivity, photosynthesis and transpiration rate, growth rate, days of maturity, moisture availability *etc.* global warming affects

directly on food production of the world. Increasing mean seasonal temperature can reduce the crop duration and so reduce the yield. Increased temperature also causes disturbs the physiological activities in crop plant and thus reduce the yield. Alteration in atmospheric composition in gases also causes both negative and little positive impact on crop physiology. The effects of global warming on agriculture is severe that it has great impact on food production and thus affect the food security so, it require special agricultural practices to combat with. Unlike all other sector, agriculture is also affected severely by global warming. It makes changes in the agricultural climate resources *i.e.* changes in sunlight, temperature, precipitation *etc.* global warming affects the both arable/livestock sector as well as hydrology sector.

The negative impact of global warming on hydrology sector include changes in underground water level and temperature, water quality of marshes and lack, river flow by impacting evaporation, precipitation, temperature rising, soil moisture content, *etc.* As temperature increase, evaporation also increases resulting in decreases in water outflow; on the other hand, increase in precipitation due to global warming leads to increases in outflow.

The impact of global warming on agricultural production can be categorized into primary and secondary effect. Primary impacts refer to changes in atmospheric composition due to increase in greenhouse gases that makes changes in energy and moisture balance in farmlands and change in crop growth response. The secondary impact refers to changes in agricultural climatic resources that are affected by primary impact including shifting in suitable land for cultivation and chemical and physical changes in agricultural soil. Global warming also causes biological changes like changes in quality, changes in flowering and harvesting season, shifting in cultivated areas, quality change, *etc.* climate change also affect the agricultural ecosystem as causing rise to population of insects and pests, also make changes in biodiversity. It also brings changes in areas like breeding of livestock and their fertilization and affects the growing pattern of pastures. Global warming also affect the rural economy including productivity, asset values and revenues of farm household and also affects the agricultural infrastructure through the changes in water resources available for agriculture. Keeping these things in mind the study entitled “Awareness level of Farmers about Global warming effect on Agricultural sectors in Navsari District” was conducted with specific objectives.

Research Methodology.

The study was conducted in Navsari District of Gujarat State. All of the six Taluka of Navsari district were covered under the study. Randomly, two villages were selected from each Taluka, thus total twelve villages were covered under study. Random sampling method was followed for selection of the respondents; from each village ten farmer respondents were selected. In this way the sample size for the study comprised for 120 respondents. *Ex-post facto* research design was used. Nineteen independent and one dependent variable were chosen. In light of the objectives, the interview schedule was prepared and respondents were interviewed at their home, field and remote places of village. The collected data were analyzed by using frequency, percentage, rank, arithmetic mean, standard deviation and correlation coefficient (r).

Result and Discussion.

Profile of the Respondents.(n=120)

Results of the investigation shown that majority of the respondents belonged to middle age category, having medium level of farming experience, with small size of land holding, with up to high school level of education, having small size of nuclear family, engage in farming alone and had membership in one organization. They used tube well as a source of irrigation, having Rs. 1,00,001 to 1,50,00 annual income, medium level of mass media exposure, medium level of

innovativeness, medium level of socio-economic status, medium level of awareness about crop insurance and medium level of extension contact. They also had medium level of risk orientation, medium level of scientific orientation, medium level of economic motivation and medium level of general knowledge about global warming.

General knowledge about global warming

Table 1: Distribution of respondents according to general awareness about global warming (n=120)

Sr. No.	Categories of general knowledge about global warming	Frequency	Percentage (%)
1.	Low	18	15.00
2.	Medium	79	65.83
3.	High	23	19.17
Total		120	100.00

(Mean=45.6)

(SD= ±10.57)

Result presented in Table-1 says that majority of the respondents (65.83 per cent) had medium level of general knowledge about global warming while, 15.00 per cent of the respondents had low level of general knowledge about global warming and only 19.17 per cent of respondents had high level of general knowledge about global warming.

In general, majority of respondents had 85.00 had medium to high level of general knowledge about global warming. This might be due to middle to high school level of education, medium level of mass media exposure, medium level of farming experience. Knowledge about global warming helps farmers in decision making process in farming situation according to situation. The medium to high level of general knowledge about global warming is highly useful to explanatory strategies adjacent to global warming effect on agricultural sector.

The findings for general knowledge about global warming are similar with findings of *Islam et al.* (2019) , *Manoj Kumar et al* (2020)and *Chohan,* (2017).

Awareness level of farmers about global warming effect on agricultural sector

Table .2: Distribution of respondents according to knowledge level (n=120)

Sr. No.	Categories of awareness level about global warming effect on agricultural sector	Frequency	Percentage (%)
1.	Low	23	19.17
2.	Medium	84	70.00
3.	High	13	10.83
Total		120	100.00

Results depicted in Tabel-2 indicate that the majority of the respondents (70.00 per cent) had medium awareness level of farmers about global warming effect on agricultural sector followed by low (19.67 per cent) and high (10.83 per cent) awareness level about global warming effect on agricultural sector. As we can see in Table 4.20, majority *i.e.* 89.17 per cent of farmers had low to medium level of awareness level about global warming effect on agricultural sector. Probable reason might be due to middle to high school level of education, medium to low level of farming experience, mass media exposure and innovativeness. Knowledge level of farmers about global warming effect on agricultural sector helps them to choose best farming practices in changing climatic situation. awareness about global warming helps them in decision making process according to climate and weather conditions which helps them to get maximum profit.

The findings about awareness level about global warming effect on agricultural sector are similar with findings of *Manojkumar et al (2020)*, *V. Sangeetha et al (2020)*, *Rajkumar et al., (2020)*, *Vasanthi (2017)* and *Kumar (2013)*.

. 4. To study the association between the independent variables with dependent variables

Table.3: Association between the characteristics of the respondents and their awareness level about global warming effect on agricultural sector

Sr. No.	Independent Variables	Correlation Coefficient ('r' value)
1	Age	-0.092 ^{NS}
2	Farming experience	0.200*
3	Land holding	0.117 ^{NS}
4	Education	0.232**
5	Type of family	0.124 ^{NS}
6	Size of family	-0.065 ^{NS}
7	Occupation	0.190*
8	Social participation	0.189*
9	Irrigation facilities	0.200*
10	Annual income	0.060 ^{NS}
11	Mass media exposure	0.184*
12	Innovativeness	0.179*
13	Socio-economic status	0.241**
14	Crop insurance	0.186*
15	Extension contact	0.266**
16	Risk orientation	0.181*
17	Scientific orientation	0.194*
18	Economic motivation	0.195*
19	General knowledge about global warming	0.248**

*Significant at 0.05 level. **significant at 0.01 level. NS = Non Significant

It was reported in Tabel-3 that the age (-0.092^{NS}) and size of family (-0.065^{NS}) was negative and non-significantly associated with awareness level of farmers about global warming effect on agricultural sector while, land holding (0.117^{NS}), type of family (0.12^{NS}), and annual income (0.060^{NS}) was positive and non-significantly associated with knowledge level of farmers about global warming effect on agricultural sector. Whereas, farming experience (0.210*), occupation (0.18989*), social participation (0.189*), irrigation facilities (0.200*), mass media exposure (0.184*), innovativeness (0.179*), crop insurance (0.186*), risk orientation (0.181*), scientific orientation (0.194*), and economic motivation (0.195*) was positive and significantly associated with knowledge level of farmers about global warming effect on agricultural sector. Education (0.232**), socio-economic status (0.241**), extension contact (0.266**), and general knowledge of farmers about global warming effect on agricultural sector (0.248**) was positive and highly significant with knowledge level of farmers about global warming effect on agricultural sector. The

findings about association between profile of the respondents and awareness level are similar with the findings of Vasanthi (2017), Joshi (2016), Uttam (2019) and Mundhe (2019). Kudale (2019), Satishkumar (2016) and Manjunath (2018).

Summary and Conclusion

Results of the investigation shown that majority of the respondents belonged to middle age category, having medium level of farming experience, with small size of land holding, with up to high school level of education, having small size of nuclear family, engage in farming alone and had membership in one organization. They used tube well as a source of irrigation, having Rs. 1,00,001 to 1,50,00 annual income, medium level of mass media exposure, medium level of innovativeness, medium level of socio-economic status, medium level of awareness about crop insurance and medium level of extension contact. They also had medium level of risk orientation, medium level of scientific orientation, medium level of economic motivation and medium level of general knowledge about global warming.

Results shown that majority of the respondents had medium awareness level about global warming effect on agricultural sector. In correlation analysis, age and size of family was negative and non-significantly associated with knowledge level of farmers about global warming effect on agricultural sector while, land holding, type of family, and annual income was positive and non-significantly associated with awareness level of farmers about global warming effect on agricultural sector. Whereas, farming experience, occupation, social participation, irrigation facilities, mass media exposure, innovativeness, crop insurance, risk orientation, scientific orientation, and economic motivation was positive and significantly associated with knowledge level of farmers about global warming effect on agricultural sector. Education, socio-economic status, extension contact, and general knowledge of farmers about global warming effect on agricultural sector were positive and highly significant with awareness level of farmers about global warming effect on agricultural sector.

5. Implication of the study

5.1 This study helps in knowing the various characteristics of farmers which provides guidelines to policy makers and extension agencies in planning and implementing the programmes related to global warming in other areas.

5.2 The findings of this study would be helpful to planners and researchers to generate data based knowledge level of farmers and find existing knowledge gap if any and help them to make various training programmes according to farmer's knowledge.

5.3 The results of this study indicate that majority of the respondents had low to medium level of awareness about global warming effect on agriculture sector. So, efforts should be made to improve knowledge level of farmers from low/medium to high level of awareness by conducting needed training and various appropriate demonstration related to global warming effect on agricultural sector.

5.4 The findings of the study would be helpful to social and research workers, extension workers, policy makers to develop future extension strategies.

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Impact Of Climate Change In Horticultural Production - A Review

M. Hariharan^{1*} And Dr. K.R. Karunakaran²

¹Department of Agricultural Economics, CARDS, TNAU, Coimbatore-641 003, India.

²Agricultural College & Research Institute, Kudumiyamalai-622104, India.

Introduction:

Climate change's present scenario is serious and alarming. Rising global temperatures have a variety of effects on the economy, society, and environment. India is one of the nations most susceptible to its effects because of its enormous population, reliance on agriculture, and lack of means to adapt to climate change. Long-term changes in the Earth's climate are referred to as "climate change," and they are mostly brought on by human activities that cause greenhouse gases (such carbon dioxide and methane) to be released into the atmosphere. The increase in Earth's temperature brought on by these greenhouse gases has a variety of effects on the environment, human communities, and the economy.

Climate plays a significant role in plant growth and the productivity of crops. Food shortages and price hikes are being caused by the impact of climate change on agricultural output, particularly

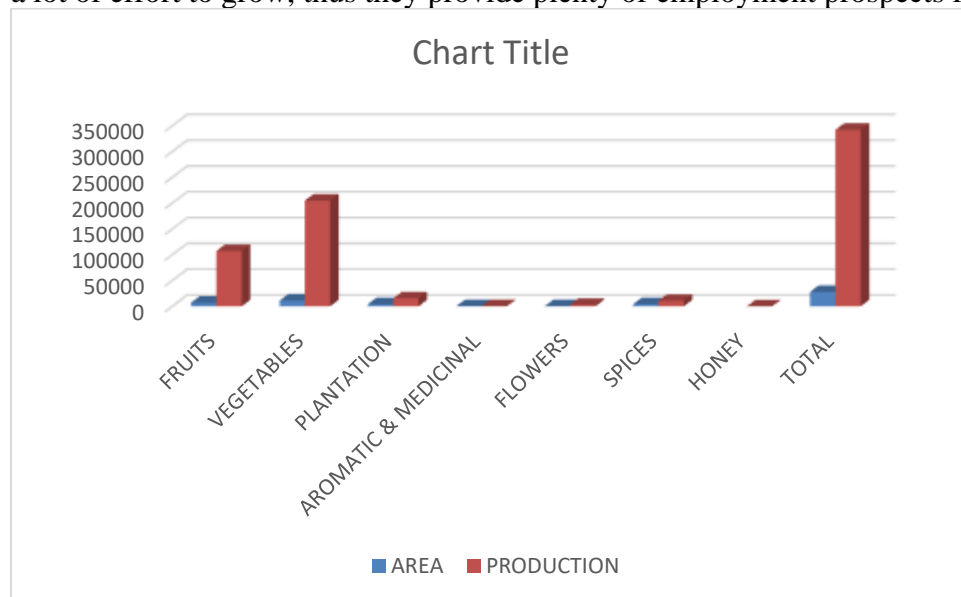
in developing nations. Heatwaves are becoming increasingly frequent and severe in India, which is having an impact on agriculture, human health, and the economy.

India's agricultural production is being impacted by climate change, as variations in temperature and rainfall patterns result in crop losses and lower yields. Horticulture output is anticipated to be significantly impacted by climate change. The Intergovernmental Panel on Climate Change (IPCC) predicts that climate change will lower food yields worldwide, with certain locations and crops being more negatively impacted than others.

CURRENT SCENARIO OF HORTICULTURE CROPS:

The area under horticultural crops has increased from 21.7 million hectares in 2014-15 to 25.66 million hectares in 2020-21, indicating the growing importance of this sector in Indian agriculture. Horticulture also provides higher returns per unit of land compared to many agricultural crops, making it an attractive option for farmers looking to diversify their income streams.

The combined area of all horticultural crops is expected to be close to 25.66 million hectares, producing 326.6 million tonnes annually. Even yet, these crops only account for around 9.6% of India's cultivated land and provide only 19.9% of the country's agricultural GDP. The export of fruits, vegetables, and medicinal plants has also shown an increasing tendency. Horticultural crops have a special place in India's economy since they raise rural residents' incomes. These crops need a lot of effort to grow, thus they provide plenty of employment prospects for the rural population.



(Source: MoA & FW 2022)

Shifts in growing seasons: Climate change can alter the timing and duration of growing seasons, affecting planting and harvesting schedules for horticultural crops. Shifts in temperature and precipitation patterns can disrupt the natural cycles of plant growth, leading to changes in flowering, fruiting, and dormancy periods.

THE IMPACT OF RISING TEMPERATURES ON HORTICULTURAL CROPS:

All horticulture crops are temperature-sensitive, and the majority have certain temperature needs for the best production and quality. High temperatures, exposure to high levels of carbon dioxide and ozone, and fresh fruit and vegetable crops can all have a direct or indirect impact on the production and quality of those products. Increased temperatures have a direct impact on

photosynthesis, changing the number of sugars, organic acids, and flavonoids as well as the firmness and antioxidant activity of the plant.

Heat stress can reduce crop yields and quality, as well as increase the risk of pests and diseases. Changes in precipitation, including droughts or heavy rainfall events, can affect irrigation practices, water availability, and nutrient management, all of which are critical for horticultural crop production.

SHIFTING PEST AND DISEASE PRESSURES:

Climate change can affect the distribution and abundance of pests and diseases that impact horticultural crops. Warmer temperatures can favor the survival and reproduction of certain pests and diseases, leading to increased infestations and outbreaks. This may require changes in pest management practices, including the use of pesticides, biological controls, and integrated pest management (IPM) strategies.

ALTERED PLANT PHYSIOLOGY:

Climate change can affect plant physiology, including growth rates, photosynthesis, and nutrient uptake, which can impact horticultural crop production. Elevated atmospheric CO₂ concentrations can influence plant growth and nutrient content, potentially altering crop quality and nutritional value. However, the responses of different horticultural crops to elevated CO₂ levels can vary, and more research is needed to understand the complex interactions between climate change and plant physiology.

CHANGES IN CROP SUITABILITY AND ADAPTATION:

Climate change can affect the suitability of certain crops for specific regions or growing conditions. Some crops may become less viable in certain areas due to changes in temperature, precipitation, or pest pressures, while other crops may benefit from warmer conditions. Horticulturists may need to adapt their crop selection and management practices to changing climate conditions, including the use of drought-tolerant or heat-tolerant crop varieties, changes in planting dates, and modifications to irrigation and nutrient management practices.

IMPACTS ON POLLINATORS:

Pollinators, such as bees, butterflies, and other insects, are critical for many horticultural crops. Climate change can affect the distribution, abundance, and behavior of pollinators, which can impact crop pollination and yield. Changes in temperature, precipitation, and plant-pollinator interactions can affect pollinator populations and their ability to effectively pollinate horticultural crops.

OPPORTUNITIES FOR INNOVATION AND ADAPTATION:

Despite the challenges posed by climate change, there are also opportunities for innovation and adaptation in horticulture. This includes the development of new crop varieties with improved heat and drought tolerance, the use of precision agriculture techniques for efficient irrigation and nutrient management, and the adoption of climate-smart agricultural practices that promote sustainable production systems. There is also a growing interest in using regenerative agriculture practices, such as agroforestry, cover cropping, and soil carbon sequestration, which can help mitigate climate change impacts and build resilience in horticultural systems.

The government of India has put into effect a number of policies and initiatives to combat the effects of climate change, such as encouraging the use of renewable energy sources, expanding the amount of forest cover, and enacting water conservation measures. To combat greenhouse gas emissions and adapt to the changing climate, however, there is a need for consistent effort at all levels. The present article reviews various aspects of climate change in horticulture hinting at future prospects.

Conclusion:

Climate change poses significant challenges to horticulture, affecting various aspects of plant growth, production, and management. However, it also presents opportunities for adaptation and innovation to build more resilient and sustainable horticultural systems in the face of a changing climate. Research, technological advancements, and proactive management practices will be crucial in addressing the impacts of climate change on horticulture and ensuring the continued production of healthy and nutritious fruits, vegetables, and flowers.

Agro-Tourism: A crossroad of tourism and agriculture for income generation in Maharashtra state**Dr. L. R. Tambade***KVK, Solapur MS PIN413255, India***Introduction**

Agri-tourism is a niche and an emerging market segment of the tourism industry. The agri-tourism market globally was valued at \$42.46 billion in 2019 and is expected to reach \$62.98 billion by 2027, registering a Compound Annual Growth Rate (CAGR) of 13.4% between 2020 and 2027. Maharashtra is pioneer in starting agri-tourism centres as a new way of farming. Agro-Tourism gives farmers an opportunity to earn extra income; it helps redistribute economic resources in the country from cities and increases the chances of rural people getting income. This generated the large no of visitors for the farm area. The purpose of Agri-tourism is to acquaint onset with agricultural products including entertainment. The Maharashtra state is pioneer for development and promotion of Agri-Tourism. At present there are more than 350 Agri-Tourism centres spread across the 30 districts of Maharashtra, the pioneer districts are Pune, Solapur, Nashik, Nagpur, Kolhapur, Ratnagiri, Sindhudurg, Thane, Sambhaji Nagar, Jalna, Dhule, Jalgaon etc. In Single Solapur district more than 35 seasonal and 18+ permanent agri-tourism centres are running and earning yearly net profit from Rs. 2.5 lakhs to 25 lakhs with generation of employment to 3-9 youth per centres.

Agro-tourism is an innovative agricultural activity related to tourism and agriculture both. It has a great capacity to create additional source of income and employment opportunities to the farmers. Maharashtra is one of the major tourist centre in the India and there is large scope and great potential to develop agro-tourism. The outcome of agri-tourism centres are viz. farmers are selling the produce / value added products at higher prizes than APMC rates, creation of jobs for family members or even locals, it opens a venue of sharing farming experiences to urban peoples and bring some real food home.

Objectives:

The objectives of this paper are follows:

To study the concept of agro-tourism.

To assess the Scope and importance of agri-tourism in Maharashtra.

Status of Agri-tourism in Maharashtra

Importance

Agriculture is the most important occupation in the India including in the Maharashtra. But, today it becomes unprofitable due the irregular monsoon, prices fluctuations of Agro-products and some internal weaknesses of the agriculture sector. Hence, there is need to do some innovative activities in the agriculture, which will help to farmers, rural people. Urban population is increasing day by day in the Maharashtra, today the urban people's world is restricted in the closed door flats, offices, clubs, television, video games, spicy fast food, computer, internet, and so on. They

can see nature only on television or screen of the computers. More over some people living in the cities do not have relatives in villages and they never visited or stayed in village. These people want to enjoy rural life but there is problem of such type of facilities. Hence, it is opportunity to the farmers for the development of the agro-tourism centers and it serves him and create additional income source.

Data Use:

The scope of the study is limited to examine the benefits and applicability of agro- tourism business in Maharashtra. The study includes concept, benefits and status of this innovative way of farming As well as it includes appropriate framework regarding to establish the agro-tourism centers in the Maharashtra. The present study was conducted

on the agro-tourism is based on online and offline secondary data. The data has been furnished from the related articles, research papers, Projects of YCMOU, reports and

Some data has been furnished from the Websites of the government of India and Maharashtra, as well as agri-tourism centers. The secondary data has also taken from B.Sc. Agri Projects of Open Agril Study Centre,(YCMOU) KVK, Solapur

Concept of Agro-Tourism:

A term 'Agro-Tourism' is a new face of tourism. An agro-tourism is farm based business that is open to the public. These specialized agro-tourism destinations generally offer things to see, things to do, and produce or gifts to buy, and are open to the public. Agri-tourism is defined as "Travel that combines agricultural or rural settings with products of agricultural operations – all within a tourism experience". According to Mr. Pandurang Tavare (ATDC, Pune) - "Agro-Tourism is that Agri-Business activity, when a native farmers or person of the area offers tours to their agriculture farm to allow a person to view them growing, harvesting, and processing locally grown foods, such as coconuts, pineapple, sugar cane, corn, or any agriculture produce the person would not encounter in their city or home country. Often the farmers would provide a home-stay opportunity and education". Agro-Tourism and Eco-Tourism are closely related to each other. Eco- Tourism provided by the tour companies but, in the agro-tourism farmers offer tours to their agriculture farm and providing entertainment, education and fun-filled experiences for the urban people.

Agro-tourism is a way of sustainable tourist development and multi-activity in rural areas through which the visitor has the opportunity to get aware with agricultural areas, agricultural occupations, local products, traditional food and the daily life of the rural people, as well as the cultural elements and traditions. Moreover, this activity brings visitors closer to nature and rural activities in which they can participate, be entertained and feel the pleasure of touring.

Requirements for Agro-Tourism Centers :

Infrastructure Facilities:

- Accommodation facilities at same place or alliance with nearest hotels.
- Farmhouse, which has the rural look and feel comfortable along with all minimum required facilities.
- Rich resources in agriculture namely water and plants at the place.
- Cooking equipments for cooking food, if tourists have interested.
- Emergency medical cares with first aid box.
- The well or lake or swimming tank for fishing, swimming
- Bullock cart, cattle shade, telephone facilities etc
- Goat farm, Emu (Ostrich bird) farm, sericulture farm, green house, etc.

Facilities Be Provided

- Offer authentic rural Indian / Maharashtra food for breakfast, lunch and dinner.
- Farmers should offer to see and participate in the agricultural activities.
- Offer an opportunity to participate in the rural games to the tourist
- Provide information them about the culture, dress, arts, crafts, festivals, rural traditions and also give possible demonstration of some arts.
- Offer bullock cart for riding and horse riding, buffalo ride in the water, fishing facility in your pounds or nearest lake.
- Offer fruits, corns, groundnuts, sugarcane and other agro-products as per availability
- Show local birds, animals and waterfalls etc and give authentic information about them.
- Arrange folk dance programme, *Shekoti* folk songs *bhajan*, *kirtana*, *lezim dance*, *dhangari gaja*, etc.

The place of agro-tourism centre must be easy accessible by roads and railways. Tourists want to enjoy some historical and natural tourist places along with the agro-tourism. Hence, the centre should be developed near of these tourist places. It is more beneficial to both tourist and farmers. The places which are already tourist centres like *Mahabaleswara*, *Panchgani*, *Nashik*, *Jotiba*, *Narshinghvasi*, *Pandharpur*, *Akkalkot*, *Konkan* etc. These are the better places for the development of agro-tourism. Other than these places farmer can develop their centers in any affordable places.

Benefits of Agro-Tourism Centers:

Agro-Tourism has the potential to change the economic face of traditional agriculture. The benefits of agro-tourism development are manifold. It would bring many direct and indirect benefits to the farmers and rural people. Some of the benefits are following.

Employment opportunities to the farmers including farm family members and youth

Additional income source for the farmers to protect against income fluctuation.

Cultural transformation between urban and rural people including social moral values

Farmers can improve their standard of living due to the contacts with urban people.

Benefits to the urban people, they can understand about the rural life and know about the agricultural activities. It support for rural and agricultural development process.

Agro-Tourism Potential and Status in Maharashtra:

Maharashtra is the third largest state of India, both in area and population. It is located on the west coast of India with a 720 km long coastline along the green Konkan region. Nestled in the Western Ghats and the *Sahyadri* mountain ranges have several hill stations and water reservoirs with semi-evergreen and deciduous forests. There are many tourist centers in Maharashtra which are the supporting natural environment for the agro- tourism centers in Maharashtra. Although, Maharashtra has a total 22368 thousand hector area under the agriculture and 36122 thousands of livestock (cow, beffelows, goats etc.). Principal crops include rice, Jowar, Bajra, wheat, pulses, turmeric, onions, cotton, sugarcane and several oil seeds including groundnut, sunflower and soybean. The state has huge areas, under fruit cultivation of which mangoes, bananas, grapes, and oranges etc.

Maharashtra is blessed with a rich and diversified cultural heritage. The state has several communities belonging to different religions, and a number of festivities colours the culture of Maharashtra with the spirit of exuberance. Some of the popular festivals that are celebrated in Maharashtra are Diwali, Ganesh Chaturthi, Gudhi Padwa, Dasara, Nag Panchami, Gokul Ashtmi,

Narali Pournima, Pola, Makar Sankranti, Banganga Festival and Holi etc. More than 4.11 core (43 percent of total) population is living in the urban areas of the Maharashtra, which will become a customer of the agro-tourist centers located in the rural areas. Other than nature and culture there is an enough road and rail connectivity in urban rural areas to travel in rural Maharashtra. Maharashtra abounds in numerous tourist attractions ranging from ancient cave temples, unspoiled beaches, ancient forts and monuments, forests and wildlife, unique hill stations, pilgrimage, centers, and a rich tradition of festivals, art and culture.

About 322 + such locations have been identified by ATDC in Maharashtra as rural agro-tourist destinations. Thus all the districts in Maharashtra have a tourism potential. Some following notable factors are helpful to the agro-tourism in Maharashtra. During the year 2017-18 more than 10.50 lakhs tourist visited the agri-tourism centers of all district of Maharashtra state.

Conclusions and Policy Implications:

Maharashtra has a great potential to the development of agro-tourism, because of natural conditions and different types of agri products as well as variety of rural traditions, festivals. More than 45 percent of population live in the urban areas and they want enjoy rural life and to know about the rural life. It is a good opportunity to develop an agro-tourism business in Maharashtra. Agro-tourism is upcoming as a innovative way of enhancing farming income, sale their produce at higher price and generation of employment to greater extent.

The output of more than 322+ agri-tourism centres in Maharashtra are seen that the farmers are selling the produce / value added products at higher prizes than APMC rates, creation of jobs for family members or even locals, it opens a venue of sharing farming experiences to urban peoples and bring some real food home. Also the visits are exceeded more than 10.50 lakhs per year with turnover of more than Rs.20-25 crore . Hence the public and private stakeholders should support the agri-tourism as a new paradigm.

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Swot Analysis Of Hi-Tech Horticulture In India

M.K. Vahini^{1*} And S. Padma Rani²

¹Department of Agricultural Economics, CARDS, TNAU, Coimbatore-641 003, India.

²Agricultural College & Research Institute, Madurai-625104, India.

Abstract:

The era of high-tech horticulture in India is vibrant and swiftly transforming by using modern horticultural technology to enhance production, quality, and sustainability. This article attempts to review the strengths, weaknesses, opportunities, and threats in hi-tech horticulture using SWOT analysis. Hi-tech horticulture is a modern technology that relies less on the environment and

requires money but has the potential to increase production and farmers' revenue. Hi-tech horticulture has become essential in the modern era of shifting climates in order to maintain the production and financial stability of Indian farmers. High-tech horticulture methods have a considerable potential to significantly reduce the effects of climate change on agriculture. In India it is expanding quickly, propelled by factors including government support, rising demand for high-value crops, and increasing farmer awareness, large private investment from domestic as well as overseas firms, which is fostering the development of new technologies, innovations, and value chains. Hi-tech horticulture's future will be influenced by a number of things, such as technology improvements, shifting customer tastes, and international trends in food and agriculture.

Keywords: Hi-tech horticulture, SWOT analysis, technology, climate change

Introduction:

Horticulture has become one of the agriculture industries with the ability to help the economy expand more quickly over time. Its contribution to the nation's plans for reducing poverty, ensuring nutritional security, and creating employment is becoming more and more crucial. It gives farmers not only a variety of alternatives for crop diversification, but also plenty of room to support a big number of agro enterprises, which create a lot of job possibilities. Hi-tech horticulture is the practice of enhancing plant growth and productivity via the application of cutting-edge technology and methods. It develops very effective and sustainable agricultural systems by fusing conventional horticulture methods with cutting-edge technology like sensors, automation, and artificial intelligence. This comprises of post-harvest management technologies, hydroponics, fertigation systems, precision farming, and greenhouse horticulture.

Hi-tech A knowledge-based horticulture system called horticulture uses technology to raise the value and calibre of agricultural output. Hi-tech horticulture is a modern technology that relies less on the environment and requires money but has the potential to increase production and farmers' revenue. Hi-tech horticulture has become essential in the modern era of shifting climates in order to maintain the production and financial stability of Indian farmers. In addition to producing fruits, vegetables, and flowers, hi-tech horticulture is important for conservation, plant protection, post-harvest management, and value-adding (Neha 2020)

Through site-specific high-tech interventions, such as fertigation, protected/greenhouse cultivation, soil and leaf nutrient-based fertiliser management, mulching for in-situ moisture conservation, micro-propagation, high-density planting, drip irrigation, etc., precision farming calls for the efficient management of resources. By putting an emphasis on crop management utilising technology like GIS, GPS, and remote sensing (RS) together with ground tools like variable rate applicators (VRA), yield monitors, and other tools, precision farming integrates environmental health, economic profitability, and social and economic equality (Das, et al 2018) The modernised, automated CEA hydroponic system offers several advantages over conventional farming, including increased efficiency, larger agricultural yields, and significant ecological benefits. Apart from these advantages, the most important component of the CEA system that requires more investigation is waste management (Srivani et al., 2019).

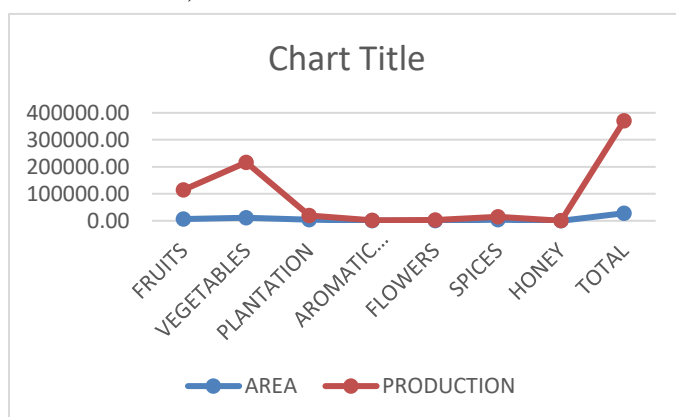
The horticultural industry offers tremendous potential for the employment of high technology since it can produce more food, flowers, and medicinal plants on a smaller amount of land than other agronomic crops. "Hi-tech horticulture" may be defined as deployment of any technology, which is modern, less environment dependent, capital intensive and has the capacity to improve the productivity and quality of horticultural crops (Bamang et al, 2022) In order to increase vegetable production in the most isolated regions of India's Odisha state, ICRISAT and the World

Vegetable Centre have built technological nurseries with natural ventilation in the state's tribal districts of Koraput, Nabarangpur, and Rayagada. In December 2021, the polyhouse nurseries began operating (ICRISAT 2022).

A large portion of the agriculture Gross Value Added (GVA) in India comes from the horticulture industry, which accounts for around 33% of the total. Along with assuring the nation's food security, it also diversifies farming operations, creates alternative rural job options, and boosts farmers' income. India is currently producing about 320.48 million tonnes of horticulture produce from less area than food grain production (25.66 million Ha. for horticulture against 127.6 M. ha. for food grains). When compared to food grain productivity (12.49 tonnes per hectare against 2.23 tonnes per hectare), horticultural crops are substantially more productive. The National Horticulture Mission's launch has increased horticulture crop production and productivity. Horticultural crop productivity expanded by 38.5% from 2004–05 and 2021–22 (MoA& FW 2022).

Horticulture Scenario in India:

(SOURCE: MoA & FW 2022)



SWOT ANALYSIS:

SWOT Analysis is an analysis method used to evaluate the ‘strengths’, ‘weaknesses’, ‘opportunities’ and ‘threats’ involved in an organization, a plan, a project, a person or a business activity (GURL 2017). Situational analysis or appraisal of the current situation are other names for it. The terms "weaknesses" and "strengths" are connected internally. The former reflects a characteristic of a company or other entity that gives it an edge over rivals. The latter is a trait of the same entity, which places it at a comparative disadvantage to its rivals. When it comes to external factors, "opportunities" are aspects of the larger environment that the entity may make use of to its advantage. However, "threats" are also realities in the larger environment, which might cause issues for the organization (Teoli 2019).

STRENGTH:

Modern, less environmentally harmful, and capital-intensive hi-tech horticulture has the potential to increase production and farmer revenue. It is a crucial part of the stakeholders' economic security. production of high-quality flowers, vegetables, fruits, and goods with added value. High-tech horticulture techniques can increase productivity per unit area, more earnings or strong returns, Utilising biotechnologies to extend crop shelf life, such as using genetically modified (GM) crops like tomato and capsicum, has greatly extended crop shelf life. (Siku et al., 2022). A potent instrument for increasing crop output by twofold, high-tech horticulture also has the potential to double farmers' income (DFI). The goal of high-tech horticulture may include the

following: i) climate-resilient production technology through high-tech interventions; ii) conservation of existing germplasm and exploitation of underutilised plant and land use with the development of new varieties/hybrids suitable for high-tech horticulture; iii) application of biotechnology and nanotechnology; and iv) precision farming oriented to targeted yield, crop, and region-specific nutrient management (Bhattacharyya et al., 2017). Hi-tech Horticulture is advantageous for value addition, plant protection, post-harvest management, and conservation in addition to growing fruits, vegetables, and flower crops. In warmer areas, vertical greening can offer a cooling potential on the building surface, which is crucial during the summer. By preventing the façade from warming up, the cooling effect of green facades also affects the inside climate of the structure. When time and space become an issue, microgreens are ideal. Vertical gardening is the ideal method for growing microgreens since it uses less time and space and is also very simple to do. Microgreens are extremely nutritious vegetables since they are not sprayed with chemicals (Reddy et al., 2022)

WEAKNESS:

Hi-tech horticulture provides numerous benefits overall, but there are also certain issues that must be resolved such as initial costs are quite expensive, requiring large amounts of cash; skilled personnel is needed to run; research and development are required; time and dedication are needed; and experience and technical expertise are absolutely essential; risks associated with power and water are constant; threats to system failure Potential for rapid disease and pest transmission. To create sustainable and inclusive high-tech horticulture systems that benefit both farmers and society as a whole, academics, policymakers, and farmers must collaborate.

Some of the issues related to hi-tech horticulture are Poor seed and fertiliser quality, a lack of high-yielding and appropriate kinds for protected farming; greenhouse lacks of professional (skilled labour) and high-quality materials; Farmers have less capacity to assume risk and less understanding of protected farming; Even in regulated environments, not all crops are lucrative.; Requires cutting-edge technology, skilled labour, and ongoing support for manufacturing; Conventional agricultural methods are used in protected structures; Increased maintenance and startup costs; Farmers' small land holdings and the diversity of their farming systems; Gaps in technology between organisations that do research, education, and extension (REE), as well as among farmers; Storage, market infrastructure (Atreya et al.,)

The following are crucial factors in promoting high-value crops are integrating an increasing number of small farmers into a high-value agriculture production system; Technology transfer; Access to institutional credit; Institutional development for input support, extension, training, and capacity building; Marketing connections to guarantee a fair price for produce on a long-term basis; Making policy interventions possible; Perishable high-value commodities like fruits and vegetables must be diversified at the same time as urgent infrastructure demands like cold storages and swift transit facilities; The lack of targeted risk mitigation strategies to counteract significant production and market-related risks (NABARD 2021)

OPPORTUNITIES:

Policies must be made simpler, and problems like closing legal loopholes in property acquisition must be addressed. Hi-tech floriculture has to be given priority as an industry. It is important to guarantee year-round, over-the-counter access to high-quality inputs like water-soluble fertilisers and insecticides. It is necessary to assess the high cost of credit, the unexpected increase in quarantine duty, and the tax on plastics that have been impeding the industry's expansion. All boundaries spanning continents have the potential to be destroyed by information technology. It is

necessary to develop an appropriate framework to protect the interests of Indian producers and consumers. Since this idea is new to Indian markets, everyone needs to receive the proper training. When high-tech horticulture is adopted, there are several opportunities that arise for individuals and businesses which include Increased Efficiency, Improved Crop Quality, Year-Round Production, New Job Opportunities, and Sustainability. New employment possibilities are appearing in fields including crop management, automation, data analysis, and software development as high-tech horticulture spreads.

THREATS:

Significant shifts in temperature and precipitation patterns are endangering crop output and making those who depend on agriculture, especially the majority of the world's poor, more vulnerable to losing their jobs. The availability of food is threatened by the effect of climate change on food markets. Threats can be lessened by improving farmers' adaptive skills, the resilience of agricultural production systems, and their resource-use efficiency (Bano et al.)

Climate change-related changes in temperature, precipitation, and extreme weather can have a negative impact on agricultural growth and yield. High-tech horticulture systems may be created to lessen these consequences, but they may also be more susceptible to dangers associated with climate change. As horticulture technologies continue to evolve, so do the pests and diseases that threaten crops. High-tech horticulture systems are often highly concentrated, which can increase the likelihood of pest and disease outbreaks. High-tech horticulture systems need a lot of water, which can be difficult in places with scarce water supplies or with low-quality water. Competition between users for water resources due to water shortage is another potential outcome. High tech horticulture systems might be exposed to cyberattacks as they grow increasingly automated and linked. These assaults have the potential to compromise private information, stop business activities, and result in losses. Regulations and compliance requirements, such as those pertaining to food safety, environmental protection, and labour standards, are all applicable to high-tech horticulture systems. It may be expensive and time-consuming to comply with, particularly for smaller farmers.

Conclusion:

We can feed the growing population while facing numerous difficulties if we combine current ideas and techniques with traditional agriculture. The globe is always creating new approaches. This will not only contribute to the sustainability of the produce but also to the improvement of farmers' financial circumstances (Neha 2020). The primary needs for the future are assistance at the policy and programme level, technological development, verification, and acceptance.

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***In Vitro* Evaluation Of Bio Control Agents Against *Colletotrichum capsici*, Causing Anthracnose Of Chilli**

SN Banne*, SA Falke, PK Dhoke, SJ Magar and SS Kadam

Department of Plant Pathology, College of Agriculture, Parbhani

Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani- 431 402 (M.S), India.

Purpose:

Biotic and abiotic stresses are major constraints in the production of chilli. Among biotic stresses apart from bacterial and viral diseases, many fungal diseases are of economic importance so an experiment conducted to study the efficacy of antagonistic organism against Anthracnose of chilli.

Method:

A total of seven fungal bioagents (*Trichoderma asperellum*, *T. harzianum*, *T. virens*, *T. hamatum*, *Metarhizium anisopliae*, *Verticillium lecani* and *Aspergillus niger*) were evaluated *in vitro* against *Colletotrichum capsici*, applying Dual culture technique (Dennis and Webster, 1971). Per cent inhibition of the test pathogen were calculated by applying formula given by Arora and Upadhyay (1978).

$$\text{PGI} = \frac{\text{Colony growth in control plate} - \text{Colony growth in intersecting plate}}{\text{Colony growth in control plate}} \times 100$$

Result:

T. asperellum was found most significant with highest mycelial growth inhibition (52.51%) of the test pathogen. The second and third most inhibitory antagonists found were *T. harzianum* and *T. virens* with mycelia growth inhibition of 48.97 and 43.13 %, respectively.

Conclusion:

Trichoderma asperellum may be used as an effective bio control agent to control *C. capsici* that causes anthracnose or fruit rot of chilli.

KEYWORDS: bio control, *Colletotrichum capsici*, *in vitro*, inhibition

***In Vitro* Evaluation Of Plant Extracts / Botanicals Against *Colletotrichum capsici*, Causing Anthracnose Of Chilli**

SS Kadam *, SA Falke, PK Dhoke, SJ Magar and SN Banne

Department of Plant Pathology, College of Agriculture, Parbhani

Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani- 431 402 (M.S), India.

Purpose:

Anthracnose disease of chilli is one of the major diseases of chilli and responsible for causing pre-harvest and post-harvest losses to the produce. Limited availability of the resistant cultivars makes the farmers to rely on fungicidal use to control the disease. The present investigation was carried out with an aim to develop some eco-friendly control measures against Anthracnose of chilli.

Method:

A total of seven fungal botanicals (*Zingiber officinale*, *Azadirachta indica*, *Allium sativum*, *Osmium sanctum*, *Allium cepa*, *Annona squamosa* and *Curcuma longa*) were evaluated *in vitro* against *Colletotrichum capsici*, poisoned food technique was followed as suggested by Nene and Thapliyal (1993). The efficacy of botanicals was expressed as per cent inhibition of mycelial growth over control which was calculated by using the formula given by Vincent (1927).

C-T

$$\text{Per cent inhibition} = \frac{\text{C-T}}{\text{C}} \times 100$$

Where, C = Growth of the test fungus in untreated control plates. T = Growth of the test fungus in treated plates

Result:

At 5 per cent, significantly highest inhibition of mycelial growth was recorded with *Allium sativum* (53.10 %), followed by *Azadirachta indica* (50.56 %). At 10 per cent, significantly highest inhibition of mycelial growth was recorded with *Allium sativum* (63.91 %), followed by *Azadirachta indica* (54.34 %).

Conclusion:

Allium sativum and *Azadirachta indica* was found very promising in inhibiting the growth of pathogen.

Keywords: botanicals, *Colletotrichum capsici*, *in vitro*, poisoned food technique

***In Vitro* Evaluation Of Fungicides Against *Claviceps fusiformis*, Causing Ergot Of Bajra**
GV Bhosale*, GP Jagtap, VM Gholve and MG Patil

Department of Plant Pathology, College of Agriculture, Parbhani

Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani- 431 402 (M.S), India.

Purpose:

Ergot caused by *C. fusiformis* is one of the most widely spread and destructive disease of pearl millet. Pathogen induces honey dew, sclerotia which accounts 70% loss in susceptible varieties and estimated 58-70% grain yield reduction in hybrids. Therefore, present *in vitro* study was planned in CRD with some botanicals/ plant extracts against *Claviceps fusiformis*

Method:

Those botanicals reported earlier effective against many pathogens and which are locally available was evaluated *in vitro* against *claviceps* ergot of pearl millet applying poisoned food technique (Nene and Thapliyal, 1993) and using PDA as basal medium. All the plant extracts were evaluated @ 5% and 10%. The percent inhibition was calculated by the following formulae given by Vincent (1927).

$$R = \{(C - T) / C\} \times 100$$

Where, R = Per cent inhibition, C= Radial growth of pathogen colony in control, T= Radial growth of pathogen colony in treatment

Result:

Neem was found most effective at 5% and 10% inhibited mycelial growth (36.66% and 48.14%) with least mycelial growth (57 mm and 43 mm) followed by Onion and Garlic (34.81 % and 45.18%) and (34.07 % and 44.07 %) with least mycelial growth (58.67 mm and 49.33 mm) and (59.33 mm and 50.33 mm) resp.

Conclusion:

Neem may be used as an effective botanical to control *Claviceps fusiformis* that causes ergot of bajra.

Keywords: Ergot, *Claviceps fusiformis*, *in vitro*, inhibition, botanicals

Effect of time of planting and bio inoculants on days to opening of 1st floret and floret diameter

Divya¹, Arvind Malik¹, Raveena²

¹ Chaudhary Charan Singh Haryana Agricultural University, Hisar (125004), Haryana

² Maharana Pratap Horticultural University, Karnal (132001), Haryana

Purpose

Gladiolus is the leading flowering plant in the international cut flower trade. It is grown for its beautiful spike worldwide and is known as the queen of bulbous flowers. The time of planting and biofertilizers plays a vital role in obtaining better growth and flowering. The time of planting is indirectly related to the temperature and day length, both of which are important for the days to opening of 1st floret and floret diameter of Gladiolus. Proper planting time provides optimum growth conditions to plant for better growth with better floret diameter and minimum days to opening of 1st floret. While biofertilizers being a source of nutrients, plays an important role in flower growth and yield of a flower also depends on the nutrient status of the soil. More yield will generate more income for farmers. Keeping in view the above facts, the present study was carried out to study the effect of time of planting time and bio inoculants on the days to opening of 1st floret and floret diameter growth and flowering of Gladiolus.

Methods

The number of days taken from the planting of corms to the opening of the first floret in the spike of each tagged plant was recorded, and the average was calculated.

The diameter of the second floret of the spike in each tagged plant was measured by a digital vernier calliper.

Results

The results revealed that the days taken to opening of the first floret differed significantly for different time of plantings and bio inoculants. With a delay in the time of planting, the number of days taken to opening of the first floret increased significantly. The minimum number of days taken to opening of first floret (96.96) were recorded in 1st fortnight of October planting.

Among different bio inoculants treatment, the minimum number of days taken to opening of first floret (96.64) was observed in plants grown under T₈ treatment (RDF + *Azotobacter* + PSB + Mycorrhiza).

Conclusions

Under North Indian conditions gladiolus can be planted on 1st fortnight of October and using bioinoculants treatment T₈ (RDF + *Azotobacter* + PSB + Mycorrhiza) to obtain optimum growth and yield. Better yield obtained generate more income for farmer and hence improve economic status of farmers.

Keywords: Gladiolus, bio inoculants, time of planting

Relationship Between Profile Of Agricultural Personnel And Their Attitude Towards E-Agricultural Portal In Sabarkantha District In Gujarat State.”.

Neha Parikh and N.M. Chauhan.

Polytechnic in Agriculture, NAU, Vyara-364 650. Dist- Tapi, Gujarat. India.

Abstract

Today's world is internet driven. It is a world in which everything is e-enabled. As agriculture sector is wide spreader sector, things involved in agriculture development are also wide spreader. In the era of information technology, technology is moving very fast and people seek more convenience, lower cost and time expenditures, and freedom from cumbersome and problematic procedures. In any government organization, the employees were retired/are retiring at large. But the new recruitment is not taking place as we expect. Due to increase in man-hours and workload, employees are overloaded with more work. They may not be able to provide the required services as expected by the agrarian community.

In India, there are a number of web portals for smart e-governance but in agriculture sector, this concept is yet to remain implemented. Different sites or web portals are there but these all are in different commands and different objectives which not able to full fill need of farmers at one address. There is e-portal for agriculture which includes agriculture related latest information, latest technology, communication about agronomical practices, information about input availability, weather, market, processing etc. Keeping in view the above said facts, this study on “Attitude of Agricultural Personnel Towards e- Agricultural Portal” was under taken with following specific **objectives:**

Result says that the independent variable computer inclination had positive and highly significant correlation with their attitudes towards e-agricultural portal. Whereas, variables like education, mass media exposure and scientific orientation had positive and significant relationship with their attitudes towards e-agricultural portal. The variable like age shows negative and significant relationship with their attitudes towards e-agricultural portals. Whereas, variables like experience, social participation, occupation and annual income had negative and non-significant relationship with their attitudes towards e-agricultural portal and their attitude towards e-agricultural portal.

The major constraints faced by the Agricultural Personnel regarding e-agricultural portal in descending order of rank were; Lack of up-to-date facilities in own office/department, Uneven speed of internet, Lack of user friendly e-agricultural portal, Lack of skill enhancement & training to agricultural personal, Lack of time, Lack of skills using all the features of internet, Lack of skills in efficient maintenance of online information and lack of dynamic facilities available on internet on the server of Government of Gujarat.

The major suggestions given by the Agricultural Personnel in descending order of rank were; Each Agricultural Personnel should be provided advanced computer set with internet facilities, the e-

agricultural portal should be modified and made it user friendly, refresher training on efficient e-agricultural portal for Agricultural personnel should be organized, work should be rational and make system easy to ensure time availability for accessing internet, compulsory provision of training should be there to create computer literacy at advance level.

Introduction

Agriculture plays an essential role in the process of economic development of developing countries like India. Besides providing food to nation, contributes to market of industrial goods and earns foreign exchange. Agricultural development is an integral part of overall economic development. In spite of this, it is also an important feature of agriculture that is to be noted that growth of other sectors and overall economy depends on the performance of agriculture to a considerable extent. Agriculture is not only the predominant occupation of many countries in the world, but it also drives the economy of several developing nations. People, the world over are recognizing the fact if the sector is to progress and become sustainable, it must quickly transform its functioning by adapting to new information technologies that assist farmers and help them improve economic performance and production. ICT has become a global tool often used by individuals, organizations, governments and inter-governmental organizations for personnel or official activities. Its application cut across all fields of human endeavor like medicine, commerce, engineering, architecture, education, library services and agriculture.

In India, there are a number of web portals for smart e-governance but in agriculture sector, this concept is yet to remain implemented. Different sites or web portals are there but these all are in different commands and different objectives which not able to full fill need of farmers at one address. There is e-portal for agriculture which includes agriculture related latest information, latest technology, communication about agronomical practices, information about input availability, weather, market, processing etc. Keeping in view the above said facts, this study on “Attitude of Agricultural Personnel Towards e- Agricultural Portal” was under taken with following specific objectives: To study the profile of agricultural personnel, to measure the attitude of agricultural personnel towards e-agricultural portal ,to ascertain relationship between profile of agricultural personnel and their attitude towards e-agricultural portal and to identify constraints faced by agricultural personnel regarding e-agricultural portal and seek the suggestions of agricultural personnel about e-agricultural portal

Research Methodology

The present study was undertaken in Agricultural department of Government of Gujarat in Sabarkantha District. The dependent variable undertaken in this study was Attitude of Agricultural Personnel towards e-Agricultural Portal. The independent variables were; age, education and experience in service as personnel variables; social participation as social variable; Occupation and Annual income as Economical variables; mass media exposure and computer inclination as communicational variables and economic motivation, scientific orientation and risk orientation as psychological variables. To study the Attitude of Agricultural Personnel towards e-Agricultural Portal, the attitude scale developed by Dr. M.C. Patel (2006) was used with some modifications. Independent variables were measured by using suitable scales and procedures adopted by various researchers with suitable modifications. An interview schedule was developed in accordance with the objectives of the study. The data of this study were collected through personnel interview. The collected data were classified, tabulated, analyzed and interpreted in order to make the findings meaningful. The statistical measures such as frequency and percentage, arithmetic mean, Karl Pearson coefficient of correlation and arbitrary method were used in the study.

Result and Discussion

1. Relationship between the profiles of the Agricultural Personnel and their attitude towards e-agricultural portal n=60

Table:1.

No.	Independent Variables	Correlation-Coefficient ('r' value)
1	Age	-0.203 *
2	Education	0.207 *
3	Experience	-0.155
4	Social participation	-0.066
5	Occupation	-0.074
6	Annual income	-0.121
7	Mass media exposure	0.214 *
8	Computer inclination	0.260 **
9	Economic motivation	0.024
10	Scientific orientation	0.205 *
11	Risk orientation	0.058

* = Significant at 5% level of probability, ** = Significant at 1% level of probability. Table $r_{0.05} = 0.197$ and Table $r_{0.01} = 0.259$.

It can be seen from the Table 1 that Result says that the independent variable computer inclination had positive and highly significant correlation with their attitudes towards e-agricultural portal. Whereas, variables like education, mass media exposure and scientific orientation had positive and significant relationship with their attitudes towards e-agricultural portal. The variable like age shows negative and significant relationship with their attitudes towards e-agricultural portals. Whereas, variables like experience, social participation, occupation and annual income had negative and non-significant relationship with their attitudes towards e-agricultural portal and their attitude towards e-agricultural portal. This finding is supported by the findings of Kunchala (2012), Patel (2006) and Jat (2009). Trivedi and Trivedi (2002), Sharnagat (2008) and Kadam *et al.* (2001). The similar trend was also reported by Darandale (2010), Chauhan (2005) and Jat (2009).

2. Constraints faced by agricultural personnel in using e- agricultural portal of Sabarkantha district in Gujarat state. (n= 60)

Table 1: Constraints faced by Agricultural Personnel regarding e-agricultural portal n=60

No.	Constraints	Mean	Rank
1	Lack of up-to-date facilities in own office/department.	1.85	I
2	Uneven speed of internet.	1.84	II

3	Lack of user friendly e-agricultural portal.(Simple user interface, Report generation, Auto update)	1.82	III
4	Lack of skill enhancement & training to agricultural personal.	1.78	IV
5	Lack of time.	1.76	V
6	Lack of skills using all the features of internet.	1.63	VI
7	Lack of skills in efficient maintenance of online information.	1.55	VII
8	Lack of dynamic facilities available on internet on the server of Government of Gujarat.	1.42	VIII

It can be seen from the Table 2 that major constraints faced by the Agricultural Personnel regarding e-agricultural portal in descending order of rank were; Lack of up-to-date facilities in own office/department(1.85 mean), Uneven speed of internet (1.84 mean), Lack of user friendly e-agricultural portal (1.82 mean), Lack of skill enhancement & training to agricultural personal(1.78 mean), Lack of time (1.76 mean), Lack of skills using all the features of internet(1.63 mean), Lack of skills in efficient maintenance of online information (1.55 mean) and Lack of dynamic facilities available on internet on the server of Government of Gujarat(1.42 mean).

3. Suggestions to overcome the constraints faced by agricultural personnel regarding e-agricultural portal

The Table 3 shows major suggestions given by the Agricultural Personnel to overcome constraints faced by regarding e-agricultural portal.

Table 3: Suggestions to overcome the constraints faced by Agricultural Personnel in regarding e-agricultural portal

n=60			
No.	Suggestions	Mean	Rank
1	Each Agricultural Personnel should be provided advanced computer set with internet facilities.	1.95	I
2	The e-agricultural portal should be modified and made it user friendly.	1.90	II
3	Refresher training on efficient e-agricultural portal for Agricultural personnel should be organized.	1.81	III
4	Work should be rational and make system easy to ensure time availability for accessing internet.	1.65	IV
5	Compulsory provision of training should be there to create computer literacy at advance level.	1.56	V

The result indicates that major suggestions given by the Agricultural Personnel in descending order of rank were; Each Agricultural Personnel should be provided advanced computer set with internet facilities (1.95 mean), The e-agricultural portal should be modified and made it user friendly (1.90 mean), Refresher training on efficient e-agricultural portal for Agricultural personnel should be organized (1.81 mean), Work should be rational and make system easy to ensure time availability for accessing internet (1.65 mean), Compulsory provision of training should be there to create computer literacy at advance level (1.59 mean).

Summary and Conclusions

It can be concluded that the independent variable computer inclination had positive and highly significant correlation with their attitudes towards e-agricultural portal. Whereas variables like education, mass media exposure and scientific orientation had positive and significant relationship with their attitudes towards e-agricultural portal. The variable like age shows negative and significant relationship with their attitudes towards e-agricultural portals. Whereas variables like experience, social participation, occupation and annual income had negative and non-significant relationship with their attitudes towards e-agricultural portal and their attitude towards e-agricultural portal.

It can be concluded again that the poor facilities like computer, internet, connectivity and all related facilities are not up to the mark at their home and office, too. This problem must be resolved by concern authorities. The problems regarding speed in connectivity and constant connectivity must be resolved to change their attitude towards e-agricultural portal. Use friendly e-agricultural portal must be avail to them for making their positive attitude towards e-agricultural portal. The sufficient and need-based trainings for them should be arranged by the authorities or concern department to make them easy and interesting use of e-portal. The time schedule of them must be arranged in that sense that they can avail a sufficient time to interrelate on e-agricultural portal. The integrated trainings on all aspect of internet use and variety of its functions may be acquitted with them for easy operation. The full fledged facilities like internet, server room, electrical facilities, *etc* must be made available to them to create their positive attitude towards e-agricultural portal. Authority should take a adequate interest in solving their constraints in a improved way.

Further it can be concluded that the all of the agricultural personnel should be given advanced computer set and internet facilities to their doorsteps and office, too. The e-agricultural portal must be modified and make it user friendly to create their interest and positive attitude towards e-agricultural portal. Refresher training for agricultural personnel must be arranged to update their knowledge and handling of recent ICT tools related to e-agricultural portal. The time schedule of them must be made in such a way that they can have sufficient time for accessing internet and other ICT based information. The compulsory computer based training for them should be made to create their interest towards ICT based information reception and to avoid their nervousness towards e-agricultural portal. The suggestions given by them must be incorporated in future strategies to create their positive attitude towards e-agricultural portal in the benefit of themselves and society, too.

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An Overview of 'Neera' Production from Coconut in Tamil Nadu

P. BALAMURUGAN^{1*} and Dr. S. SENTHILNATHAN²

¹*Department of Agricultural Economics, CARDS, TNAU, Coimbatore-641003, India.*

²*Tamil Nadu Agricultural University, Coimbatore-641003, India.*

Introduction:

Coconut:

Coconut (*Cocos nucifera* Linn.) an important commercial plantation crop of India plays an important role in the Indian economy. The coconut palm, *Cocos nucifera* Linn., with its tall, slender and uniformly thick stem and massive crown with large number of leaves, bearing bunches of nuts in their axils is one of the most beautiful and useful trees in the world.

Neera:

Neera, also called palm nectar, is a sap extracted from the inflorescence of various species of palms and used as a drink. Neera extraction is generally performed before sunrise. It is sweet, translucent in colour. It is susceptible to natural fermentation at ambient temperature within a few hours of extraction, and is also known as palm wine (toddy). Once fermented, Neera becomes toddy. Neera is widely consumed in India, Sri Lanka, Africa, Malaysia, Indonesia, Thailand, and Myanmar. Neera is not the juice made from palm fruit. It is obtained by slicing the spathes of the coconut, and scraping the tendermost part, just below the crown. In Tamil Nadu, Neera is also called "Padaneer" in Tamil, and is traditionally extracted and sold under the brand name "Kallu". KVIC and Tamil Nadu Palm Products Development Board sell refrigerated Padaneer at their outlets. Neera syrup is used as a drink in Ayurveda

Tamil Nadu Neera Rules, 2017

About eight crore coconut trees are in the state under an area of 10.74 lakh acres of land. Farmers have long been demanding that the state allow them to produce Neera from the trees to augment their profit.

As per the guidelines, the given licence would be valid for a year and it should be renewed every year in March. Besides producing Neera, the farmers can also manufacture other value-added products from them.

The Neera extraction would be consistently monitored by the officials and violation of food safety standards would result in cancellation of the permit. The number of permits to be granted in each district would be decided by the officials, the government order said. The farmers had been protesting against the ban on neera extraction when neighbouring states like Kerala and Karnataka are allowing it since it is considered as a health drink due to its high nutritive and medicinal value. Kerala had granted licences to coconut producers' societies and federations to tap neera in specified quantities in the year 2014 and it is being processed and marketed. Following the Kerala model, Karnataka government too had amended laws to allow neera tapping by farmers.

However, the state government was hesitant since neera could easily be fermented and turned into toddy in a matter of hours. But, farmers organisations had questioned the policy as why neera is banned, while IMFL is allowed in the state.

After some discourse Government has formulated some rules and acts and allowed the Neera tapping in Tamilnadu state.

Neera tapping rules likely to be relaxed for the benefit of coconut farmers in Tamil Nadu

The Department of Agriculture and Farmers' Welfare is considering relaxation in Tamil Nadu Neera Rules for the benefit of coconut farmers. A meeting was held at November, 2022 in this regard in which Director of Agriculture Marketing and Agri Business participated.

Farmers demanded provisions to get the neera licence online and suggested that the ceiling on 5 % of total coconut trees should be removed. He also said the Coconut Producers Company need not be registered with Coconut Development Board. These were discussed at the meeting in which the Government suggested that the Agricultural Marketing and Agri Business Department made arrangements for the applicants to submit the application and obtain the licence online. It also said the Coconut Producer Companies need not register with the Coconut Development Board to get the licence but they can do so to avail of the benefits extended by the Board. Regarding the ceiling on number of trees for tapping, the government is looking at enhancing the number to 25 % from the current 5 %.

The government is expected to issue an order in this regard within a month and it will benefit coconut farmers and producer companies. If the order is issued, coconut producer companies can apply online and tap neera from 25 % trees.

Farmer Producer Organisation (FPO)

As per state government Neera tapping is not allowed to farmers alone. So that they should form a farmers producing organisation in order to withhold production and marketing of Neera.

Farmer Producer Organization is formed with the main objective of socio economic development of farmers through

- Productivity improvement
- Cost reduction
- Efficient aggregation
- Processing for value addition
- Better by-product utilization
- Efficient marketing of the produce

It aims at providing a fair, steady and remunerative income to farmers by organizing the unorganized coconut sector through farmer collectives.

Coconut Neera Sugar

Coconut Neera Sugar extracted from the aromatic nectar of the coconut inflorescence, the sap is dried and granulated to make fine coconut sugar. It's low glycemic index makes it an healthy alternative to refined cane sugar. It is also ultra low in fructose, which makes all the more beneficial replacement for cane sugar. Besides is is also rich in nutrients like iron, zinc and antioxidants

The coconut palm syrup or jaggery can be crystallized to produce fine granules of sugar. Transition of coconut jaggery into a ground granule sweetener is more accepted by global markets. The recovery of palm sugar from coconut palm jaggery is 15%. The application of this sugar is tremendous and offers huge potential owing to its most important health attributes, the low Glycemic index and the high nutrient content. It can be the most suited alternative sweetner, especially when agave sugar is being rejected owing to the high fructose content.If we convert jaggery further to coconut palm sugar, value addition is still better.

Why Neera Sugar?

Coconut sap or Neera is obtained by tapping or cutting the spathe of coconut. The main constituent of the coconut sap juice is sugar (14-18 per cent) the physical and chemical composition of freshly collected coconut blossom "sap" or "nectar" indicates that it is naturally rich in Potassium, Magnesium, Zinc and Iron and is a natural source of 12 of the essential vitamin B complex and vitamin C and has a neutral pH.

Conclusion and policy measures:

Coconut sugar is a healthy sweetener compared to most of the other commercially available sugars. It is processed by evaporating the sap/neera/Kalparasa, and its collection from the tree, its transport, storage and processing involves lot of men and material. Hence the production cost is high compared to cane sugar. Because of its nutritive value and low GI, people are prepared to pay high price but lack of awareness about its health benefits is a bottleneck. The scientific advancements in sap collection and processing that took place in India during the last few years saw hygienic production of natural coconut sugar and various bio-products. However, still the tapping of coconut in most of the states in India is under excise and requires license, lack of common facility centers and support for packaging and marketing are the major limitations in production and supply of coconut sugar in India as compared to some of the other coconut growing countries like Indonesia and The Philippines. However, it is realized that adoption of automation practices like IOT, wireless communications, machine learning and artificial intelligence, deep learning may substitute for human labor and reduce the production cost

Challenges, Patterns and Trends in Commodity Future Trading in India with reference to NCDEX

R.DHIVYA^{1*} and Dr.M.PRAHADEESWARAN²

¹Department of Agricultural Economics, CARDS, TNAU, Coimbatore-641003, India

²TamilNadu Agricultural University, Coimbatore-641003, India

Introduction:

Agriculture forms the backbone of the Economy. About 60% of the peoples depends on agriculture for the livelihood and contributes about 18% of GDP of the country. But the farmers are facing many risks in Agriculture like marketing risk, price risk, financial risk etc. Agricultural Marketing refers to the process of selling agricultural goods from the point of production to the point of consumption. The stages involved in Agricultural Marketing are Transportation, storage, processing, packaging, and distribution of agricultural products.

There are many participants in the agricultural marketing system, including farmers, traders, wholesalers, processors, retailers, and consumers. Different interactions between these participants

help to promote the sale of agricultural goods. But there are several challenges like Market imperfections, Infrastructure, Market power, Regulatory Authority etc. India is one of the top producers of a large number of commodities ranging from agricultural to nonagricultural products, with a long history in its trading market.

The Ministry of Agriculture and Farmers' Welfare estimates that India's agricultural exports were worth USD 33.14 billion during April to November 2021. The National Horticulture Board estimates that India's horticulture exports were worth USD 1.5 billion from April to September 2021. By utilising commodity exchanges, agricultural marketing in India is going through a tremendous revolution. The commodity Derivative Exchange which regulates commodity exchanges are

A. National Multi Commodity Exchanges

- 1) Multi Commodity Exchange of India Ltd., Mumbai (MCX)
- 2) National Commodity & Derivatives Exchange Ltd., Mumbai (NCDEX)
- 3) ACE Derivatives and Commodity Exchange, Mumbai. (ACE)
- 4) National Multi Commodity Exchange of India Ltd., Ahmedabad (NMCE)
- 5) Indian Commodity Exchange Ltd., Mumbai (ICEX)
- 6) Universal Commodity Exchange Ltd, Navi Mumbai (UCX)

B. There are some Commodity Specific Regional Exchanges

- 7) The Chamber of Commerce, Hapur
- 8) Rajkot Commodity Exchange Ltd., Rajkot
- 9) India Pepper & Spice Trade Association, Kochi
- 10) Bombay Commodity Exchange Ltd, Mumbai
- 11) Spices & Oilseeds Exchange Ltd, Sangli
- 12) Cotton Association of India, Mumbai

ADVANTAGES OF COMMODITY TRADING:

Price Discovery: By giving buyers and sellers a platform to trade agricultural commodities based on supply and demand variables, commodity exchanges improve price discovery.

Transparency: By providing transparent pricing, commodity exchanges enable traders and farmers to make well-informed decisions about the purchasing and selling of agricultural products.

Hedging: Using futures and options contracts, commodity exchanges give farmers and dealers a way to protect themselves against price risks.

Market Access: Farmers have access to a greater choice of buyers and a way to sell their goods directly to consumers thanks to commodity exchanges.

Infrastructure Development: By promoting investment in storage and transportation facilities, commodity exchanges help to improve the infrastructure supporting the agricultural industry.

DISADVANTAGES OF COMMODITY TRADING:

Lack of Knowledge: Many farmers are unaware of the advantages of utilising commodity exchanges for agricultural marketing.

Limited involvement: Due to issues such a lack of infrastructure, high transaction costs, and low literacy rates, farmers' involvement in commodity exchanges is restricted.

Regulatory Framework: To encourage ethical trading practises, there is a need for clear rules and regulations. The regulatory framework for commodity exchanges in India is currently developing.

Commodity Transaction Tax (CTT) introduced in 2013 could be cited as another factor that led to market uncertainty. Although agricultural commodities were exempted from CTT, change in number of exempted commodities increased (from 23 in June 2013 to 61 in February 2015) could have negatively affected volume of trade.

National Commodity & Derivatives Exchange Limited (NCDEX) is an Indian online commodity and derivative exchange based in India. It is under the ownership of Ministry of Finance, Government of India. It has an independent board of directors and provides a commodity exchange platform for market participants to trade in commodity derivatives. It is a government company, incorporated on 23 April 2003 under the Companies Act, 1956 and obtained its Certificate for Commencement of Business on 9 May 2003. It commenced operations on 15 December 2003.

LIST OF COMMODITIES TRADING UNDER NCDEX:

Cereals and Pulses: Chana, Barley, Bajra, Wheat, Moong, Maize feed, Paddy (Basmati)- Pusa 1121

Fibres: Kapas, 29mm cotton, Kapas, Long Staple Cotton, Medium Staple Cotton.

Spices: Turmeric, Coriander, Jeera (Cumin), Red Chilli, Cardamom.

Oil and Oil seeds: Castor seed, Refined Castor Oil, Cotton seed Oil cake, Soyabean, Refined Soy oil, Mustard seed, Crude palm Oil, Natural whitish sesame seeds.

Soft Commodities: Gur, Robusta cherry AB Coffee

Guar Complex: Guar seed, Guar Gum Refined splits.

Others: Rubber, Cashew, Cashew Kernel, Sugar, Gur, Coffee, Silk, Sugar

ENTREPRENEURSHIP DEVELOPMENT OPPORTUNITIES IN COMMODITY TRADING:

This commodity trading will avails many benefits to various stakeholders like farmers, Exporters, Importers, Traders etc.

Benefits to Farmers:

Realising the best price for agricultural products at the time of sale; guaranteeing trade and payment; reducing handling and other activity costs; and having access to a national market that is transparent and allows for direct selling to processors or end users. Due to the availability of warehouse receipt financing, holding capacity has increased. Market intelligence reports

Benefits to Corporates, Processors, Exporters, Importers

choosing an e-trading platform that meets their needs

Promotes bulk purchasing procedures without counterparty and quality risks

Personalised storage and logistics services

Access to expert grading and standardisation services

Complete avoidance of inconveniences associated with physical market operations

Advantages to APMC Traders

This Provides the Common national level platform for buying and selling of commodities and

There is no counter party risk in trade

Procurement and disposal of huge quantity possible.

It gives transparent price for future trading.

Advantages to Arbitrageurs

Easy mechanism for sale of deliveries received on Futures Market

Advantage of cash-future arbitrage electronically Advantages to Financial

Ready base of select producers for institutional linkages

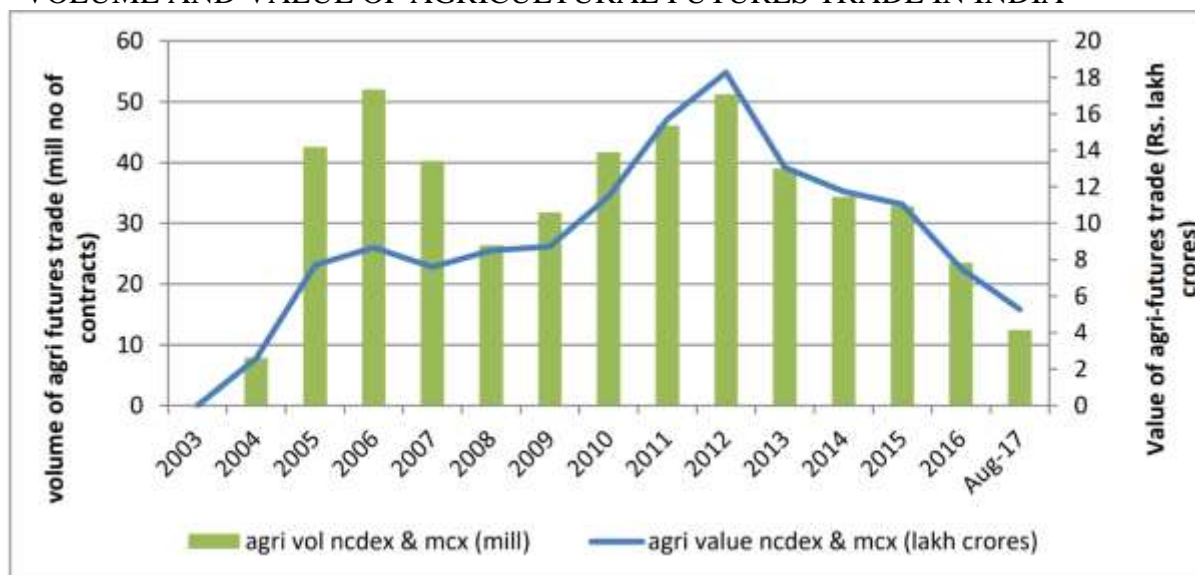
NCDEX is a leading agricultural commodity exchange in India with an average daily turnover of Rs 1,18,163.78 Lakhs in 2020, much higher than the Rs 11,318.05 Lakhs in 2003. It was marked that the Indian commodity market expanded almost by 50 times in a span of 5 years from Rs 665.30 billion in 2002 to Rs 33,753.36 billion in 2007.

The larger NCDEX Group through its subsidiaries, provides an integrated and holistic market infrastructure including Clearing & Settlement services, Repository services and even an e-Auction Platform.

NCDEX is deeply committed to the national objective of upliftment and development of farmers and the agricultural sector in general and our relentless efforts to connect the primary producer to the Exchange has paved the way for sustainable and inclusive growth of our agrarian economy.

Our key shareholders like Life Insurance Corporation of India (LIC), National Bank for Agriculture and Rural Development (NABARD), National Stock Exchange of India Limited (NSE), Canara Bank, Punjab National Bank (PNB), and Indian Farmers Fertiliser Cooperative Limited (IFFCO) are among the architects of India’s economic success story in the past few decades.

VOLUME AND VALUE OF AGRICULTURAL FUTURES TRADE IN INDIA



Source: NCDEX and MCX

National Commodity Derivative Exchange (NCDEX) has assigned commodity specific scores for each parameter in the criteria circulated by SEBI. We find that the scores given by NCDEX, for chana or sugar, are very high. High scores indicate high prospects of a commodity in futures trade. But steep margins and suspension of trade in chana and steep margins for sugar in the past indicate that these commodities belong to ‘sensitive category’ and therefore attract Government intervention.

We estimate Principal Component Analysis models to compute commodity specific scores for some commodities like Rice, Wheat, Chana, Turmeric, Sugar and Cotton.

To determine relationship between Spot and Futures prices in the agricultural commodities, co integration analysis will be used. Power BI software will be used for forecasting the prices of commodities under trading.

Sensitivity of a commodity is another vital characteristic which determines its prospects. Given the history of steep margins and suspensions on those commodities which are sensitive from the perspective of Government intervention and food security, we use two measures of sensitivity-

(1) procurement at Minimum Support Prices (MSP) or other Government schemes

(2) average monthly positive price (WPI) deviation from the trend in the last five years.

Higher score is given to the commodity if it is not procured through any Government scheme and had lower average positive price deviation in the last five years.

Commodity market has a great potential to become a separate asset class for market savvy investors, arbitrageurs and speculators. Commodities are easy to understand unlike equity market. The retail investors should understand the risk and advantages before entering into commodity market.

CONCLUSION:

Therefore, a successful commodities derivative market can reduce price risk for all participants in an agricultural value chain. Since its massive introduction in 2003, the value and volume of the agricultural futures market in India have seen a roller coaster. For market-savvy investors, arbitrageurs, and speculators, the commodity market has a tremendous deal of potential to develop into a distinct asset class. Contrary to the equity market, commodities are simple to comprehend. Retail investors should be aware of the benefits and risks before investing in the commodity market. According to statistics from the prior year, commodity futures pricing is less erratic than that of stocks and bonds, making it a useful tool for portfolio diversification. Thus Commodity Exchanges gives more entrepreneurship opportunities to invest in Commodity Markets.

Microtopography Of The Eggshell Of An Amblyceran Louse, *Menopon gallinae* Linnaeus, 1758 And An Ischnoceran Louse, *Lipeurus tropicalis* Peters, 1931 Infesting Red Jungle Fowl, *Gallus gallus* (Linnaeus, 1758) Using Scanning Electron Microscopy

Aftab Ahmad

Zoological Survey of India, Northern Regional Centre, Kaulagarh Road Dehradun (Uttarakhand), India.

Purpose:

The aim of this study is to identify the lice at the species level since adult lice frequently lack substantial intergeneric physical changes and are thus challenging to distinguish from other species.

Methods:

Feathers bearing of fresh eggs of were obtained from host body and fixed in 2.5 % glutaraldehyde and passed through 0.2 M phosphate buffer, dehydrated, arranged on aluminum stubs covered with double sided cellotape, gold coated and examined under SEM.

Results

The egg shell of *Lipeurus tropicalis* Peters, 1931 is miniature rice grain-like elongated structure (0.67–0.89 mm in length and 0.15-0.18mm in width). The anterior end of the egg is capped with an almost dome-shaped operculum (0.07–0.10 mm in diameter), and 15–18 micropyles are arranged near the opercular rim of the egg. The rear end of the egg shell bears a prominent beehive, like a hydropyle. The entire chorion of the egg is smooth and does not show any marking or sculpturing. The egg chorion of *Menopon gallinae* Linnaeus, 1758, is smooth and ovoid in shape

(0.45mm in length and 0.18–0.22 mm in width). The opercular disc bears a thick rod-like polar thread structure that arises from the anterior end of the operculum, which curves downward towards the operculum, thus making a hook-like structure. The egg mouth bears 15–18 small filaments like apophyses, which are arranged in single rows.

Conclusion:

The present report furnishes further information on the nature of egg shell of two phthiraptera species one is ischnoceran- *Lipeurus tropicalis* Peters, 1931 and other amblyceran species *Menopon gallinae* Linnaeus, 1758 infesting red jungle fowl, *Gallus gallus* (Linnaeus, 1758) using scanning electron microscopy with the help of Scanning Electron Microscopy.

Keywords: Phthiraptera, Amblycera, Ischnocera, Louse, Egg shell, SEM.

***Ailanthus excelsa* Roxb. : A potential botanical insecticide for eco-friendly management of pulse beetle (*Callosobruchus chinensis* L.)**

Soumya Kotanoor^{1*}, Sushila Nadagouda¹, Rachappa V¹, S. G. Hanchinal¹, Sharanagouda H², Roopa Bai, Rs²

¹Department of Agricultural Entomology,

²Department of Processing and Food Engineering,
University of Agricultural Sciences Raichur, 584104

Abstract

Purpose: Chickpea is one of India's most important legume crop. There is an increase in storage losses due to insect pests, the most important of which is the pulse beetle (*Callosobruchus chinensis* L.). Since chemical pesticides are not tolerated in food storage as it remains as residue, use of botanicals and other safe methods are the best choice to combat this pest. Therefore, investigations were made to explore leaf extract of *Ailanthus excelsa* to combat bruchid problem in chickpea.

Methods:

Supercritical fluid extract of *A. excelsa* was extracted using supercritical carbon dioxide during 2020-21. Supercritical fluid extract of *A. excelsa* leaves and *A. excelsa* leaf powder, a control and chemical check malathion, as well as sweet flag rhizome powder as a standard check, were used as treatments. Adult mortality, oviposition deterrence, adult emergence, seed damage and seed weight loss were recorded.

Results: The supercritical fluid extract at 0.5 per cent caused 100% mortality with maximum oviposition deterrence and no adult emergence. Chickpea seeds treated with SFE of *A. excelsa* at 0.5 per cent showed no seed damage or weight loss and it was significantly superior to other treatments of *A. excelsa* SFE and leaf powder.

Conclusion:

The supercritical fluid extract of *A. excelsa* proved to be having a strong insecticidal property and can be used as an alternative for chemical pesticides especially in the storage of food crops where we cannot use chemicals, there SFE of *A. excelsa* stands as the best option. It is also beneficial to human beings as it is having health benefits and it has the least mammalian toxicity.

Keywords: *Ailanthus excelsa*, botanicals, chickpea, pulse beetle, supercritical fluid extract.

Economical losses due to abiotic and biotic stresses in cotton crop in Punjab

G.S. Romana and R.K. Arora

¹PAU, Regional Research Station Bathinda, Punjab, India

Purpose:

Cotton being known as "White Gold," is the world's leading fiber crop. It is also an important *Kharif* crop of the South-Western region of Punjab because it is the most suitable alternative diversified crop of paddy due to its less water requirement, more employment generation as well as having leading income potential nature. During the past years cotton productivity has been influenced by the number of abiotic and biotic stresses which caused economic losses in cotton crop. During *Kharif 2022*, cotton crop faced the maximum abiotic and biotic stresses which not only decreased its yield but deteriorated the fibre quality also. So the present study was designed to analyse the economic losses caused by these abiotic as well as biotic factors and to draw some conclusions to mitigate these challenges / losses.

Method:

The various production parameters being adopted by the farmers were taken from the regular cotton crops survey while the weather parameters and various abiotic and biotic stress losses were taken during the continuous monitoring and surveillance of the cotton crop in the cropping season 2022. Simple tabular analysis was carried out to assess the unrecommended practices prevailing in the farmers field, the productivity and quality losses due to various abiotic and biotic factors and find correlations among these.

Results

The unrecommended *Bt* cotton hybrids, delayed sowing, under dosages of fertilizers, more dependence on private pesticide dealers coupled with biotic stresses (cotton leaf curl virus disease, fungal foliar leaf spots, bacterial blight, Pink Boll worm, whitefly) and abiotic stresses (Para wilt, drying of the cotton crop due to water stagnation, Droppings, Tirak, scorching of the leaves/mortality of the seedlings due to the high temperature etc) cumulatively cause the economical losses. An incidence and the severity of the CLCuD was found to be comparatively higher in the *Kharif 2022* as compared to the previous years due to adoption of unrecommended *Bt* cotton hybrids and the high population count of its vector i.e. white fly.

The comparative high temperature during *kharif 2022* had shown the drastic impacts right from the sowing phase causing poor germination, scorching of the leaves and mortality of cotton plants / seedlings. To overcome the said problem, farmers had to use the higher seed rate of expensive *Bt* cotton hybrids resulting additional cost. During 2022, Cotton leaf curl virus disease was another menace which caused 50-60 per cent yield loss as its incidence and severity were recorded high. Whitefly became the serious pest of cotton in 2022 due to the changing climatic conditions, more area of *sathi moong* that acts as alternate host and un-recommended susceptible *Bt* cotton hybrids specially from Gujarat state. It caused sooty mould problem in cotton affecting productivity and lint fibre quality also. In addition Pink boll worm has now become the another established threat in cotton for last 1-2 years in the state.

Conclusion:

All the above said factors jointly resulted in 40 to 50 percent yield loss in cotton. Further poor quality cotton lint fetched poor prices in the market. Though cotton price was as high as Rs.10000 per quintal in the market during 2022 but the Punjab farmers has got on an average Rs.8000 to 9000 per quintal. During the past years the productivity of cotton had increased to the record level of 827 kg lint per hectare in 2019-20. But declined there after significantly up to 437 kg lint per hectare during 2021-22 due to these abiotic as well as biotic stresses. Further 2022 is supposed to be the worst year for cotton in the state with estimated cotton area has gone down to about 2.5 lakh hectares and the production of hardly 235 kg lint per hectare till end February 2023. A joint and more coordinated efforts need to be carried out to save this oxygen crop of the state.

To summarise the conclusion it is hereby reported that cotton is a highly sensitive crop with respect to abiotic as well as biotic stresses. However for employment generation, for preserving the natural resource base and for maintaining the bio-diversity in the state agriculture, there is an urgent need to address these cotton problems. Worrying the seriousness of the cotton situation in the state the Punjab government has taken some encouraging steps for the 2023 cotton crop, The government has assured the regular canal water supply for the cotton belt of the state to confirm the timely sowing of cotton crop. Further 33 percent subsidy on the recommended *Bt* cotton hybrids is another positive step towards increasing the area under best cotton hybrids. Further the biotic challenges can be easily addressed following the recommendation of the Punjab Agricultural University. However there is need to strengthen the R&D system so that some weather forecasting model can be developed to predict the weather behaviour well in advance so that the necessary arrangement can be made to mitigate the abiotic losses.

Keywords: Cotton, Economical losses, abiotic and biotic stress.

Exposed and at Risk: The Intersection of Vulnerability and Climate Change
Hemu Rathore, Charu Nagar, Suman Singh, Rekha Vyas and Gaytri Tiwari

*College of Home Science (CCAS), Maharana Pratap University of Agriculture and Technology
Udaipur (Rajasthan)INDIA*

Purpose

Climate change is of ultimate concern to economists, ecologists, and agriculturalists as agriculture and climate change closely relate. While farmers have to amend their practices suffering from weather changes, the impact of modern agriculture on climate change cannot be denied. Thus, the connection between industrial agriculture and climate change demands keen attention as the influence is far from beneficial. Climate change adaptation strategies in agriculture and mitigation of negative effects are primary tasks nowadays. The aim of the Research was to assess the perception of farms about impact of climate change and the adaptive capacity to climate change

Methods

The questionnaire method of data collection was used. A sample of 240 women farmers was selected for the study from two districts of Rajasthan falling in AER V A viz Chittorgarh and Pratapgarh.

Results

This study examined the impact of climate change on a rural community in India using a survey of 240 households. The results showed that overall food production had decreased by 25% due to changes in rainfall patterns and increased pest infestations. This was further compounded by a decrease in water availability for irrigation and a decrease in natural sources of water.

Food sufficiency across the year was also impacted, with 45% of households reporting food shortages for 8-12 months of the year. Livestock diversity had decreased, and there was an increase in social conflicts related to water availability.

However, there were some positive developments, including an increase in the availability of water for drinking and a decrease in waterborne diseases. Community assets such as schools and health centers were largely unaffected.

Conclusions

These findings highlight the urgent need for targeted interventions to support rural communities in adapting to the impacts of climate change. Strategies such as improved water management, diversification of crops and livestock, and conflict resolution mechanisms could help mitigate the negative effects of climate change on vulnerable communities

Keywords: Rural Communities, Climate Change, Agriculture, Water Resources, Food Security, Human Health, Livestock, Crop Diversity, Social Conflicts, Community Assets, Wildlife.

Community Institution And Farmer Producers Company A Role Model For Empowerment Of Farmers: A Case From Backward District Of Odisha, India

Sarita Das and Shantanu Raj

Centre for Agri-Management, Department of Business Administration, Utkal University, Bhubaneswar, Odisha, India, Pin Code: 751004

RESEARCH ABSTRACT

Purpose: The future of Indian Agriculture to a great extent lies in induction of investment and appropriate technology for promotion of cash crop, scaling up productivity and return to the primary producers. As technology is not scale neutral and induction of appropriate technology requires an optimum size of the holding, fragmented holdings with small and marginal farmers constitute bulk (about 86.2% of the total land holding) pose huge impediments across the entire value chain. The traditional value chain network lacks supportive and effective coordination with in the market integration and often seriously constrain ability of the primary producers in getting the best from a given market condition. Over the period, the low sectoral performances have a concern towards agricultural sustainability along with the livelihood of primary stake holder, whose part of share is less in consumer price. Since independence several attempts have been made for promoting cooperative of farmers for pooling their resources but unfortunately barring few sectors and specific geographic areas like success of milk cooperatives in Gujarat, Cooperative movements in general have faced limitation. In this background, amendment of IX A in Section 581 of Companies Act 1956 in 2003 provided an alternative by facilitating incorporation for Farmers Producers Company.

Methods:

Kalahandi was chosen as our area under study because of the tribal population who are small and marginal farmers and the access and awareness to govt schemes has a low penetration. In this verge of cropping diversity, technological innovation, market competition, it is need of hour for collective approach for leverage the benefits to the members of FPC. The methodology we adopted in our study is qualitative research through primary and secondary survey, Focus group Discussion, interview method.

Results:

The study has examined the role of social and community institution in strengthening the Farmer producer's company. Due to various reasons, traditional Cooperatives lost their vibrancy and efficiency. As an alternative to the traditional cooperative, Farmer Producer Company has evolved from market thrust and orientation, which provide for flexibility, vertical integration and coordination with better backward and forward linkage. This area was chosen for study as it is predominantly inhabited by tribal, majority of who are small and marginal farmers, with limited

access and awareness to govt schemes. In this era of cropping diversity, technological innovation, market competition; there is a need for collective approach for leveraging the benefits to the primary producers, who have come together under the umbrella of Farmer Producers Company (FPC). The farmers were mobilised by advocating the cost benefit analysis of Seeds production and processing. KARRTABYA as a community Institution provide a hand holding support to the producers through Knowledge, Financial, Market linkage & Farmer Welfare Activities. It has been found that as an Institution, FPC has been able to gear up for protecting the interest of the small and marginal farmers from the effect of liberalization.

Conclusion:

The working model of Producers Company and benefit that can be obtain when farmers group work with collective approach in primary production, processing, value addition and marketing. Collective and collaborative approaches have enabled them to face the market competition and safeguard their interest by effective bargain with the opponents, importers and traders. The innovative business model of GHUMRA SEED PROCESSING COMPANY LTD (GSPCL) has not only made the development sustainable but also led to multiple advantages in the studied area.

Keywords: Farmer Producers Company, Community Institution, Business Model

Assessment Of Drudgery In Groundnut Cultivation And Mitigation Through Technology Intervention

Suman Singh, Hemu Rathore, Rekha Vyas and Gayatri Tiwari

Maharana Pratap University of Agriculture and Technology, Udaipur (Raj) Pin: 31300.INDIA

Purpose

Most of the drudgery prone tasks performed by women in agriculture are cutting, uprooting, transplanting, weeding and sowing and post-harvest tasks like manual threshing of maize millet and pulses, sieving and cleaning. Even for groundnut after the harvesting removal of nuts and cleaning of groundnut seeds are also performed manually. Thus, the present study was done with the major objective to assess drudgery in women dominated activities in groundnut cultivation. And to introduce

selected drudgery reduction technology in identified drudgery prone activities.

Methodology:

The study was conducted in selected villages of Bichiwada tehsil of Dungarpur district of Rajasthan. Descriptive cum exploratory research design was used. Multi stage sampling was used for the study. Drudgery in groundnut cultivation was assessed on six parameters, viz; Physical load, Posture, Repetitive strain, Physiological load, musculo-skeletal disorders and Time used. The intervention with improved tool was limited only to selected drudgery prone activities in groundnut cultivation.

Results:

It was found that the Physical load (17.77) was maximum followed by MSD load (16.70), Repetitive load (11.19), Physiological load (8.17), Time load (8.17) and the least load was that of Postural load (7.89). The overall average Drudgery load for groundnut cultivation was 70.03/150, while Drudgery Index was 44.45 depicting Moderate to Heavy drudgery in cultivating groundnut crop.

Introduction of improved tools/ technology for Stripping and Decortications proved very useful for respondents in terms of drudgery reduction and efficiency in work performance. The total drudgery score for traditional stripping was 23.68/30.00, which reduced to 14.75/30.00 when done

with comb stripper. Similarly, total drudgery score for traditional decortications was 24.95/30.00, which reduced to 14.35/30.00 when done with groundnut decorticator.

Conclusion:

Good health has long been acknowledged as one of the most critical element to quality of life. The health of women is a vital resource to protect as all the activities revolve around them. Technology intervention helps in drudgery reduction and improves health and well being and consequently improves quality of life of the worker. The drudgery was reduced when respondents used comb stripper and groundnut decorticator and also increase in output. Exposure and awareness of safety and health at work will improve the health of the workforce engaged in agriculture.

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Influence Of Planting Dates On The Incidence Of Rice Pests

N. Chaudhari, V. J. Tambe, P. R Panchbhai and P. N. Dawane*

College of Agriculture, Nagpur-440001, Maharashtra, India

**Regional Fruit Research Station, Katol (Dr. PDKV, Akola)*

Introduction

Rice (*Oryza sativa* L.) belonging to the family Gramineae is the staple food for a large part of the world's population. There is need to enhance the rice production, but a number of abiotic and biotic stresses are the main constraints. Intensive cultivation of rice has resulted in the frequent occurrence of biotic stresses that formed as major constraints in rice production. Weather condition influence the various growth and development stage of crop and indirectly, the incidence of pests and diseases (Yoshida and Parao, 1976). These changes in sowing and planting dates have profound influence on the incidence of biotic stresses mainly insect pests. Earlier efforts have been made to study the influence of date of planting on insect pest incidence and population dynamics in rice crop by ICAR- Indian Institute of Rice Research, Hyderabad and others (Karuppuchamy and Gopalan, 1986, Umeh, 1998, Magunmde *ret al.*, 2013, Singh *et al.*, 2013 and Tetarwalet *al.*, 2014).

Objectives : To study the influence of date of planting on insect pest incidence and population dynamics.

Methodology :

Most popular variety PKV HMT was planted at three dates *viz.*, normal planting - as per the recommended package of practices of the region, early planting - 20 days earlier to normal planting and late planting - 20 days later than the normal planting. The date of sowing was decided on the basis of expected date of onset of monsoon in the respective years. The field experiment consisted of three treatments and ten replications were laid out in randomized block design (RBD) with spacing of 20 cm X 15 cm and plot size of 500 m². 1500 m² area was divided into 3 plots of 500 m². Each time nursery sowings and plantings were done separately in 500 m² area. Observations on insect pest incidence were recorded at 10 days interval starting from 10 days after transplanting. Incidence of gall midge, stem borer, leaf folder, brown plant hopper, white backed plant hopper and green leaf hopper was recorded in all the plantings on PKV HMT grown in this trial.

Results

Five year cumulative pooled results indicate that, there was no much more difference found in incidence of stem borer i.e. dead hearts (DH) and white earheads (WE) in different planting dates. Mean dead heart damage was low in early planting (5.16 %) followed by normal planting (5.85 %) and high in late planting (6.77%), while white ear damage was low in late planting (5.85 %) followed by early planting (7.45 %) and high in normal planting (8.13 %) (Table 1). High mean incidence of gall midge (2.92 – 17.71% silver shoots) was observed with significantly higher damage in late planting (17.71 % silver shoots) followed by normal planting (9.90 % silver shoots) and lowest in early planting (2.92 % silver shoots) (Table 2). Low mean incidence of leaf folder (1.78 – 2.25 % damage), brown plant hopper (3.74 – 5.06 no.hill⁻¹), white backed plant hopper (1.31 – 1.59 no.hill⁻¹) and green leaf hopper (1.11 – 1.50 no.hill⁻¹) were recorded in different plantings (Table 3 and 4). Early planting (46.06 q ha⁻¹) yielded more, was superior to other treatments and followed by normal planting (41.17 qha⁻¹) and late planting (23.03 q ha⁻¹). 23.03 and 18.14 q ha⁻¹ higher yield was recorded in early planting as compared to normal and late planting, respectively. Similarly, yielded 100 and 78.76 per cent more in early planting as compared to normal and late planting, respectively.

Mangunmder *et al.* (2013) found that early planted rice had lower pests and natural enemy's population than later-transplanted rice.

Conclusion

From the study carried out during *kharif* 2016-2020 at ARS, Sakoli, the present findings conclude that the early planting significantly reduced the incidence of gall midge followed by normal planting and highest incidence was exhibited in late planting. No significant difference was found in incidence of stem borer in different planting. Low incidence of leaf folder, brown plant hopper, white backed plant hopper and green leaf hopper were recorded in different plantings. Highest yield was exhibited in early planting and followed by normal planting.

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Development of Seeding Attachment for Combine Harvester for Direct Sowing of Wheat during Paddy Harvesting to Mitigate Paddy Residue Burning

Dilwar Singh Parihar, Mahesh Kumar Narang and Baldev Dogra

Department of Farm Machinery and Power Engineering, Punjab Agricultural University, Ludhiana, India

Purpose

Paddy is the crucial staple food for more than 50% of the global population. Nearly 90% of the world's paddy is cultivated in Asia, covering 143 Mha of land, and producing 640 million tons of paddy annually. In India, total area under paddy and wheat cultivation is 44.6 Mha and 23.9 Mha respectively. In Punjab, paddy and wheat is cultivated on more than 3.0 and 3.5 Mha respectively, which generates about 22 million tonnes paddy straw every year. In the North Western part of India, more than 75% of the paddy area is harvested with the combine harvesters. After combine harvesting, usually a considerable amount of loose straw along with standing stubble are left in the field. These trail of loose residues and standing stubbles interferes with the land preparation and

seeding of the wheat crop. This residue needs to be managed through incorporation and/or mulching for timely sowing of wheat. Currently, straw incorporation or direct sowing of wheat in stubble fields requires highly energy-intensive machinery and time to achieve desired results. In light of this, an effort is being made to increase the utility of the combine harvester for sowing wheat crop along with harvesting of paddy crop simultaneously.

Methods

The developed seeding attachment having the width of 3 m which is equal to the size of cutter bar of combine harvester. The seeding attachment consist of 14 concave disc furrow openers spaced at 225 mm apart. The furrow openers were mounted on two gangs making an angle of 23° from the perpendicular line from the travel direction. This gang angle helps to reject the side thrust exerted by the soil as well as makes the self-engaging action of the furrow openers. Which helps in better straw handling ability and penetrate the disc at desired depth. Two hydraulic cylinders were installed with the frame of the combine harvester for smoothly lifting and lowering the seeding attachment while operating. Seeding attachment has been supported with two lower link arrangements provided at the rear of the combine harvester. A 60 hp tractor mounted combine harvester was used to attach the seeding unit behind the harvester. To evaluate the performance of the seeding attachment three levels of forward speeds (i.e. 1.5, 2.1 and 2.8 km/h) and stubble heights (i.e. 380, 450 and 520 mm) were selected as independent parameters. The dependent parameters were plant emergence per meter length, effective tillers per meter length, grain yield, fuel consumption and field capacity of the combine harvester.

Results

The result indicate that the forward speed and stubble height has significant effect on the plant emergence per meter length and effective tiller per meter length. As forward speed and stubble height increased the plant emergence per meter length and effective tiller per meter length significantly decreased. Whereas the effect of forward speed on the grain yield was found to be significant. The highest plant emergence per meter length and effective tillers per meter length was observed at lowest forward speed and stubble height combinations. The average field capacity, fuel consumption, and grain yield of the developed attachment were found 0.43 ha/h, 14 l/ha, and 4408 kg/ha respectively.

Conclusions

The utility of a combine harvester improved, reduced energy and time associated with conventional practices. The total energy used for wheat crop establishment using the developed seeding attachment was 1343.2 MJ/ha which is about 63.35% of the average energy demand from other methods (2113.46 MJ/ha). The current study indicated a significant gain in energy-use efficiency, and a reduction in environmental mitigation is possible with developed seeding attachment. The potential of seeding attachment with combine harvester as increasing its adaptability by the farmers at a fast pace in India due to labour shortage, residue burning, and associated economics. From the energy point of view, it would be energy and time-saving for the farmer.

Keywords: Combine harvester, Conservation agriculture, Direct seeding, Paddy-wheat, Seeding attachment

Studies on Yield Enhancement of Pigeonpea [*Cajanus cajan* (L.) Millsp.] Through Drip Irrigation and Fertigation Management**G.D. Gadade*, D.N. Gokhale and U.M. Khodke***Agricultural Technology Centre**Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani- 431 402, (MS), India***Purpose**

Erratic rainfall distribution pattern exposes pigeonpea to dry spell during its vegetative stage and terminal drought at reproductive stage and the poor crop nutrition further results in to low yield. In this scenario adoption of modern agronomic practices like drip irrigation and fertigation is the need of hour to augment the efficient use of water and fertilizer and eventually boost the yield of pigeonpea. Keeping this view in mind attempts were made to explore the yield potential of pigeonpea under drip irrigation and fertigation management.

Methods

The present investigation was undertaken at the experimental farm of AICRP on Irrigation Water Management, VNMKV, Parbhani (MS) during *kharif* 2018 and 2019. The present experiment was laid out in split plot design with main plots comprising of four drip irrigation levels viz. 0.6, 0.8, 1.0 Etc (crop evapotranspiration) and conventional method and sub plots were allotted to four fertigation levels viz. control (no fertilizer), 80% RDF, 100% RDF (25: 50: 25 NPK kg ha⁻¹) and 120% RDF.

Result

Drip irrigation at 0.8 Etc recorded higher seed yield, water use efficiency, nutrient use efficiency and net returns of pigeonpea followed by 1.0 Etc except in case of water use efficiency. As regards to fertigation studies, higher values of seed yield and water use efficiency were recorded with drip fertigation @ 25:50:25 NPK kg ha⁻¹ closely followed by 20:40:20 NPK kg ha⁻¹. However higher nutrient use efficiency and net returns were obtained in drip fertigation @ 20:40:20 NPK kg ha⁻¹.

Conclusion

Application of drip irrigation at 0.8 Etc scheduled at alternate day along with 20:40:20 NPK kg ha⁻¹ in ten splits through water soluble fertilizers out of which 20% N and 40% P in two splits at 0- 30 DAS, 30% N, P and 25% K in three splits at 31-60 DAS, 30% N, P and 40% K in 3 splits at 61-90 DAS and 20% N and 35% K in two splits at 91-120 DAS was found productive and profitable for pigeonpea.

Impact Of Rainfall Distribution Pattern On Soybean Productivity Innorthern Karnataka**P. S. Pattar, H.Venkatesh , J. R. Hiremath P Lavanya ,R. B. Jolli And S.S. Karabhantanal***AICRP on Agrometeorology, Regional Agricultural Research Station Vijayapura UAS,Dharwad-Karnataka,India***Purpose**

Rainfall is one of the important weather parameters which influence on growth, development and yield of crop plants. The variability of total rainfall received in the season and rainfall distribution influences on productivity of annual crops. The total amount of rainfall received and its distribution varies from district to district. The moisture deficit situations in dry land areas of northern Karnataka results in low productivity due to deficit/scanty and ill distribution of rainfall, mid season droughts etc. The present study undertaken to establish relationship between rainfall distribution in different months during south west monsoon and yield of Soybean in northern Karnataka. Considering the Agroclimatic Atlas of Karnataka prepared and released by

AICRPAM Vijayapura and Bengaluru Centers as the base, an attempt was made to identify the climatic constraints in Pigeon pea growing districts of Karnataka by categorizing the districts in to high area-high productivity, high area-medium productivity and high area-low productivity.

Methodology

Taking “Agroclimatic Atlas of Karnataka” prepared jointly by Vijayapura and Bengaluru Centers as base, delineation of crop productivity zones was performed. During the present year identification of rainfall pattern for different productivity zones was performed for Soybean crop as it is one of the major oil seed crops grown during kharif season mainly under rainfed condition using updated rainfall and crop yield data.

Data Used :

Rainfall : Updated District wise monthly rainfall data up to 2018.

Crop yield : Updated District wise crop yield data of Soybean up to 2018-19.

Crop productivity zones:

Soybean is the third major oilseed crop grown in Karnataka. Its area and production has shown considerable increase from 2004-05 onwards. Districts covered under different productivity zones of Soybean crop as per the information generated in the Agroclimatic Atlas of Karnataka and the recent updated data available, are given in Table 1.1. Ten years data from 2009-10 to 2018-19 was used for analysis. It has an average productivity of 1000-1200 kg/h in the major Soybean growing districts of north Karnataka.

Crop	HH	HM	HH-HM
Districts	Belagavi and Bidar	Dharwad	-
Average Productivity (kg/h) from 2009-2018	953	909	44
Standard deviation of Productivity	368.8	259.2	396.7
Coefficient of Variation (%)	38.7	28.5	897.4

The three districts coming under primary zone of Soybean cultivation were selected Out of which High acreage two districts namely Bidar and Belagavi fall in the category of High productivity zone and one district namely Dharwad fall in the category of Medium productivity zone. The rainfall pattern identified for the high yield and medium yield category are presented in this report.

Results

The rainfall pattern of the districts with High yield (HH) is considered as suitable rainfall pattern for getting higher productivity. The rainfall characteristics of the two sets of districts with High and Medium productivity are presented in Table 1.2

Rainfall characteristics of Soybean High acreage districts :

Table 1.2. Mean Rainfall (mm) variations of High acreage High productivity (HH) and High acreage Medium productivity (HM) districts of Soybean

Month / combination of months	HH	HM	(HH-HM)
MAY	47.8	85.4	-37.7
JUNE	97.6	98.9	-1.3

JULY	223.4	122.9	100.5
AUGUST	189.2	96.4	92.8
SEPTEMBER	191.4	112.8	78.6
May + June	145.4	184.3	-38.9
June + July	321.0	221.8	99.2
July + Aug	412.6	219.3	193.3
Aug + Sept	380.6	209.2	171.4
May + July	271.1	208.3	62.8
June + Aug	286.8	195.3	91.5
July + Sept	414.8	235.7	179.0
May + June + July	368.7	307.2	61.5
June + July + Aug	510.2	318.2	192.0
July + Aug + Sept	604.0	332.1	271.9
May to Sept	749.3	516.4	232.9

From Table 1.2 it is noticed that in the seasonal rainfall distribution (From pre-sowing month of May to September), rainfall was lower in May by about 40mm, equal in June and higher by about 100, 90 and 80mm during July, August and September respectively in High productivity districts. In case of standard deviation, it was higher in May and June, but lower in July, August and September in Medium productivity districts. Similarly, the coefficient of variation of rainfall in May, June, August and September was higher, but slightly lower in July. The greater variability in four out of five months increases the risk level for the Medium productivity districts.

Table 1.3. Correlation Coefficients for Soybean productivity with rainfall in different months and combination of months in High and Medium productivity districts

	HH	HM	HH-HM
MAY	-0.42	0.20	0.30
JUNE	0.39	-0.32	-0.46
JULY	0.10	0.21	0.53
AUGUST	-0.04	0.28	-0.16
SEPTEMBER	-0.13	-0.31	-0.15
May + June	0.17	-0.05	-0.39
June + July	0.25	-0.08	-0.17
July + Aug	0.05	0.30	0.49
Aug + Sept	-0.14	-0.08	-0.20
May + July	0.00	0.25	0.73
June + Aug	0.21	0.01	-0.45
July + Sept	0.00	-0.10	0.51
May + June + July	0.17	0.09	-0.07
June + July + Aug	0.17	0.13	-0.18
July + Aug + Sept	-0.02	0.03	0.46

May to Sept	0.03	0.01	-0.09
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Looking at the individual zones of High and Medium productivity districts, it is noticed that the rainfall in any of the months or combination is not significantly associated with productivity in both high and low productivity zones. The rainfall in pre-sowing month of May has negative association with productivity but has positive association in June in High productivity districts. The case is reversed in Medium productivity districts. On the other hand, in July, August and September months, there is practically no association between rainfall and final productivity in High productivity districts, but positive correlation in July and August but negative correlation in September. Among combination of months, June+July is important for high productivity districts, whereas May+July is important for Medium productivity districts.

From table 1.3 it is observed that there is drop in productivity from HH zone to HM zone (Productivity in HH minus productivity in HM) is positively and highly significantly influenced by rainfall in May+July combination ($r=0.73$) and positively and significantly with July rainfall alone ($r=0.53$). Further the rainfall in combination months of July+September ($r=0.51$) and July+August ($r=0.49$) also shows high but non significant correlation coefficient with productivity deviation. Therefore it is inferred that rainfall fluctuations in July month, which is having greater standard deviation in high productivity zone is very critical. On the other hand, the rainfall in the month of June ($r=-0.46$) and June+August ($r=-0.45$) shows non significant negative correlation, indicating the negative influence of rainfall particularly of June, as governed by rainfall in Medium productivity districts.

Conclusion

Considering the Agroclimatic Atlas of Karnataka released by our Centre as the base, an attempt was made for identifying the climatic constraints in “High area – High productivity” districts of Soybean crop compared to the “High area – Medium productivity” districts and “High area – Low productivity”. By studying the patterns of rainfall during individual and combination of months, it is inferred that May and July rainfall are important for higher productivity of the crop. It is noticed that 200 to 250 mm is the optimum rainfall for high productivity in the high productivity districts, where further increase in rainfall during July would hamper the crop yields. On the other hand, in the Medium productivity district of Dharwad, the productivity is hampered by natural rainfall of less than 200 mm in July, which suggests suitable irrigation could enhance the productivity in the district.

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Design & Analysis of Adjustable Roof Canopy: A Review

¹Saurabh S. Chakole, ²Nilesh Awate, ³Ashish Raut

Department of Mechanical Engineering, G. H. Raisoni College of Engineering Nagpur, India

Abstract

This review paper provides a comprehensive overview of the design and analysis of adjustable roof canopies in modern architecture. The paper covers various types of adjustable roof canopies, their structural components, and the design considerations that need to be taken into account. The analysis section discusses the various methods used to analyze the structural performance of adjustable roof canopies. Additionally, the paper presents notable applications of adjustable roof canopies in modern architecture, such as in sports stadiums and cultural centers. The challenges and future directions section discusses the challenges faced in the design and analysis of adjustable roof canopies and potential solutions to these challenges, as well as the future directions for research and development in the field. This review paper serves as a valuable resource for architects, engineers, and researchers interested in the design and analysis of adjustable roof canopies.

Keywords: *Adjustable roof canopies, Design considerations, Structural analysis, Membrane structures, Sustainability*

Introduction

Adjustable roof canopies have become an increasingly popular feature in modern architecture due to their versatile functionality and aesthetic appeal. These canopies can provide shade, and shelter from the elements, and enhance the overall appearance of a building's exterior [1]. Furthermore, they offer the flexibility to adapt to changing weather conditions, making them a valuable addition to any structure. The use of adjustable roof canopies dates back to ancient times, where they were commonly used in Mediterranean and Middle Eastern architecture to provide shade and shelter from the intense sun. Over time, the design and function of adjustable roof canopies have evolved, and they have become an important feature in modern architecture [2].

One of the key advantages of adjustable roof canopies is their ability to adapt to changing weather conditions. This is particularly important in areas where weather patterns can be unpredictable or extreme, such as areas prone to hurricanes or high winds. Adjustable roof canopies can be designed to be easily retracted or expanded, allowing them to provide the necessary shelter and protection in any weather conditions [3]. Another important advantage of adjustable roof canopies is their aesthetic appeal. They can be designed to complement the architectural style of a building, and their unique shapes and designs can add visual interest and character to the exterior of a structure. This can enhance the overall appeal of a building, making it more attractive to potential tenants or visitors. The importance of adjustable roof canopies in modern architecture is highlighted by the significant attention they have received from researchers and architects [4]. A number of research papers have been published in recent years on the design, analysis, and applications of adjustable roof canopies [5].

Mani et al. [6] explored the design and analysis of a retractable canopy system for a building's facade. The study analyzed the structural performance of the system under various load conditions and found that the design was capable of withstanding the expected loads while maintaining its functionality.

Zhu et al. [7] examined the use of adjustable roof canopies to improve the energy efficiency of buildings. The study found that adjustable roof canopies could significantly reduce the amount of solar heat gain entering a building, thereby reducing the need for air conditioning and improving the building's overall energy efficiency.

Rokicki et al. [8] demonstrated the significance of adjustable roof canopies in modern architecture and highlight the need for further research and development in this area. The objective of this review paper is to provide a comprehensive overview of the design, analysis, and applications of adjustable roof canopies. The paper will explore the various types of adjustable roof canopies and

their structural components, as well as the methods used to analyze their structural performance. The paper will also examine the various applications of adjustable roof canopies in modern architecture and the challenges faced in their design and analysis. Table 1 shows selected research related to Canopy with key parameters.

Table 1: Selected Research Related to Canopy with Key Parameters

Study Title	Focus	Research Method	Study Site	Key Findings
"Structure and Function of the Global Canopy"	Examines the role of the canopy in regulating global climate and biodiversity	Literature review	Global	Canopy regulates global climate and plays a critical role in maintaining biodiversity
"Effects of Canopy Gaps on Understory Microclimate and Plant Community Dynamics in a Temperate Deciduous Forest"	Investigates the effects of canopy gaps on microclimate and plant community dynamics in a temperate deciduous forest	Field experiment	Northeastern United States	Canopy gaps increase light and temperature in the understory, which affects plant community dynamics
"The Carbon Balance of Tropical Forests: Testing Predictions from Two Models against Field Measurements"	Compares the predictions of two models of the carbon balance of tropical forests to field measurements	Modeling and field measurements	Amazon and Borneo	The models overestimate carbon uptake and underestimate carbon release in tropical forests
"Drought Responses of Two Gymnosperm Species with Contrasting Leaf Lifespan and Their Successional Status in a Subtropical Forest"	Explores the drought responses of two gymnosperm species with contrasting leaf lifespan in a subtropical forest	Field experiment	Southern China	Species with longer leaf lifespan have higher drought resistance and are more successful in the early stages of succession
"Canopy Structure and Light Interception in Quercus Spp. Stands in Relation to Forest Decline"	Investigates the relationship between canopy structure, light interception, and forest decline in Quercus spp. stands	Field experiment and remote sensing	Eastern China	Declining forests have less complex canopy structure and lower light interception compared to healthy forests

"Quantifying the Functional Diversity of Forest Canopies: A New Application of LiDAR Remote Sensing"	Describes a new method for quantifying the functional diversity of forest canopies using LiDAR remote sensing	Remote sensing and statistical analysis	Global	The method can accurately quantify the functional diversity of forest canopies and identify the drivers of canopy diversity
"Canopy Functional Traits and Their Association with Carbon Fluxes in a Tropical Rainforest in China"	Examines the association between canopy functional traits and carbon fluxes in a tropical rainforest in China	Field experiment and modeling	Southern China	Canopy functional traits, such as leaf mass per area and maximum height, are important predictors of carbon fluxes in tropical rainforests
"Impacts of Tropical Cyclones on Canopy Structure and Forest Dynamics in a Bornean Lowland Rainforest"	Investigates the impacts of tropical cyclones on canopy structure and forest dynamics in a Bornean lowland rainforest	Field experiment and remote sensing	Borneo	Tropical cyclones can significantly alter canopy structure and affect forest dynamics, with implications for carbon and nutrient cycling

These research papers demonstrate the significance of adjustable roof canopies in modern architecture and highlight the need for further research and development in this area. The objective of this review paper is to provide a comprehensive overview of the design, analysis, and applications of adjustable roof canopies. The paper will explore the various types of adjustable roof canopies and their structural components, as well as the methods used to analyze their structural performance. The paper will also examine the various applications of adjustable roof canopies in modern architecture and the challenges faced in their design and analysis.

Design

The design of adjustable roof canopies can be a complex process that requires careful consideration of several factors. In this section, we will explore the various types of adjustable roof canopies and their structural components, as well as the design considerations that need to be taken into account when designing these structures [9].

2.1 Types of adjustable roof canopies

2.1.1 Retractable Canopies: Retractable canopies are designed to be easily retracted or extended, providing flexible protection from the elements. These canopies are often used on residential patios or commercial outdoor spaces, such as restaurants or cafes [10].

2.1.2 Motorized Canopies: Motorized canopies are similar to retractable canopies, but they are operated by a motor rather than by manual effort. This makes them particularly useful for larger structures or areas where manual operation would be difficult [11].

2.1.3 Fabric Canopies: Fabric canopies are typically made from durable materials such as canvas, polyester, or PVC-coated polyester. These canopies are often used for outdoor events or as shade structures in public spaces [12].

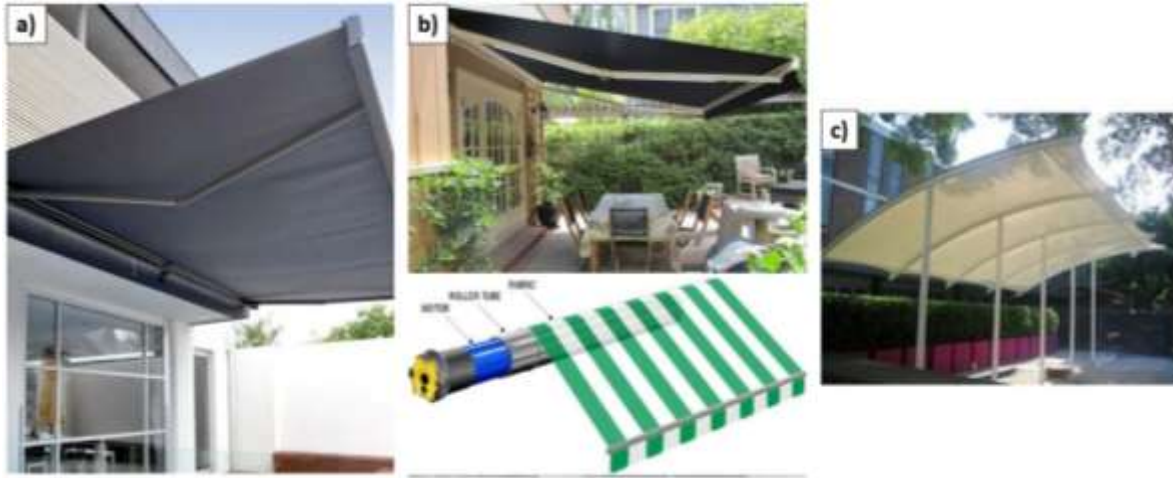


Figure 1: (a) Retractable Canopies (b) Motorized Canopies (c) Fabric Canopies

2.2 Structural Components of Adjustable Roof Canopies: The structural components of adjustable roof canopies can vary depending on the type of canopy and its intended use. However, some of the most common structural components include:

2.2.1 Support Frames: The support frame is the backbone of the canopy and is typically made from aluminum or steel. The design of the support frame will depend on the size and shape of the canopy, as well as the expected loads [13].

2.2.2 Hinges: Hinges are used to connect the support frame to the canopy cover, allowing the canopy to be easily retracted or extended. Hinges can be made from a variety of materials, including steel or brass [14].

2.2.3 Tensioning Systems: Tensioning systems are used to ensure that the canopy cover remains taut and secure, even in high winds or other adverse weather conditions. These systems can include cables, springs, or other mechanical components [15].

3. Analysis

3.1 Analytical Methods for Structural Analysis

Analytical methods are used to predict the structural behavior of adjustable roof canopies under various loads and environmental conditions [16]. Some of the most common analytical methods used for the structural analysis of adjustable roof canopies include mathematical modeling and simulation. Mathematical modeling involves using mathematical equations to predict the structural behavior of the canopy. This method requires a detailed understanding of the structural components and their properties, as well as the loads and environmental conditions that the canopy will be subjected to. Marzaeva [17] presented a mathematical model for analyzing the spread of canopy forest fires in the presence of fire breaks and barriers consisting of hardwood trees. The model solves Reynolds equations for turbulent flow with chemical reactions and uses the control volume method to obtain a discrete analogue. Numerical calculations were conducted to determine the distribution of various fields, including velocity, temperature, oxygen concentrations, and volume fractions of the condensed phase. The model allowed for the determination of the contours

of the spread of canopy forest fires based on various parameters such as forest combustible materials, moisture content, and wind speed and direction [18].

Finite Element Analysis (FEA) is a numerical method used to simulate the behavior of complex structures under different loads and environmental conditions. This method involves dividing the canopy into smaller elements and analyzing the behavior of each element using mathematical equations. Dasari et al. [19] presented a design approach for structurally optimizing the geometrical form of a building in the conceptual design phase. The method is demonstrated on a canopy of an ecological island, using parametric design models and finite element simulations. The redesigned canopy meets various requirements and improves structural efficiency and design collaboration between the architect and engineer.

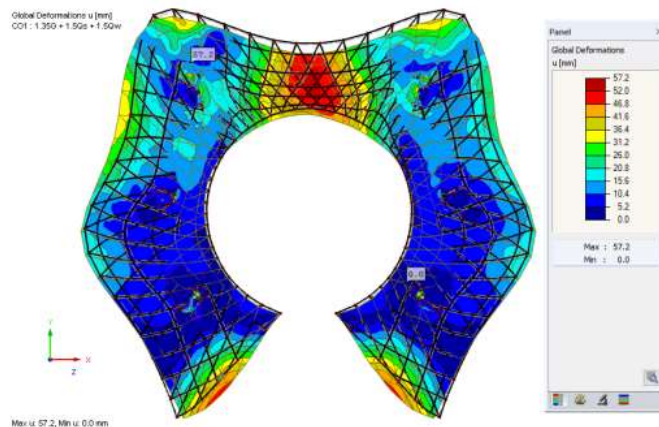


Figure 2: Finite element analysis of the roof surface

Computational Fluid Dynamics (CFD) is a numerical method used to analyze the flow of fluids, such as air, around the canopy. This method can be used to predict the wind loads and aerodynamic performance of the canopy [20].

3.2 Experimental Methods for Structural Analysis

Experimental methods are used to validate the analytical models and to verify the structural performance of the canopy. Some of the most common experimental methods used for the structural analysis of adjustable roof canopies include physical testing and field monitoring. Physical testing involves subjecting the canopy to various loads and environmental conditions to measure its structural behavior. This method can be used to verify the accuracy of the analytical models and to identify any potential structural weaknesses. Field monitoring involves installing sensors on the canopy to measure its structural performance over time. This method can be used to detect any changes in the structural behavior of the canopy, such as deformation or damage [21].

3.3 Factors Influencing Structural Performance

The structural performance of adjustable roof canopies is influenced by several factors, including the type of canopy, the design, the materials used, and the environmental conditions.

3.3.1 Type of Canopy: The type of canopy will affect its structural performance. For example, retractable canopies are generally less robust than fixed canopies and may require additional structural support.

3.3.2 Design: The design of the canopy is also a critical factor in its structural performance. A well-designed canopy should be able to withstand the expected loads and environmental conditions without deforming or failing.

3.3.3 Materials: The materials used in the construction of the canopy will also affect its structural performance. Common materials used in the construction of adjustable roof canopies include aluminum, steel, and fabric.

3.3.4 Environmental Conditions: The environmental conditions, such as wind loads, snow loads, and temperature changes, will also affect the structural performance of the canopy. Canopies designed for use in high wind or snow load areas will require additional structural support to prevent failure [22].

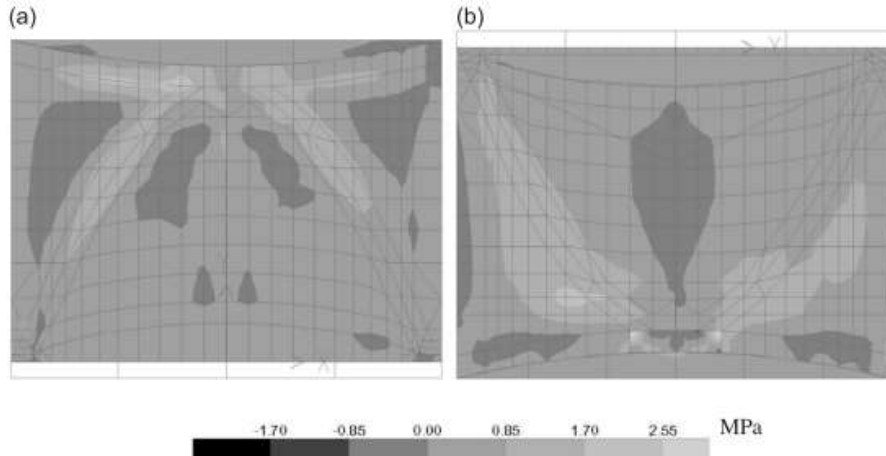


Figure 3: Stresses due to the critical snow load on the canopy: (a) on the upper surface, (b) on the underside [23]

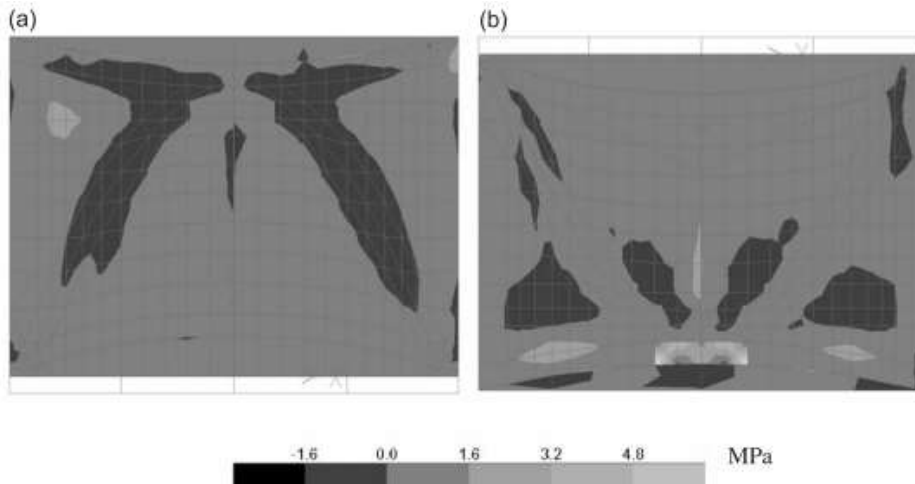


Figure 4: Stresses due to the critical wind load on the canopy: (a) on the upper surface and (b) on the underside [23]

5. Challenges and Future Directions:

Adjustable roof canopies offer many benefits to modern architecture, including increased versatility, energy efficiency, and improved aesthetics. However, there are several challenges associated with their design and analysis that need to be addressed. In this section, we will discuss the challenges and future directions for adjustable roof canopies [24].

Mao and Luo [25] highlighted the challenges involved in designing and analyzing retractable roof structures. The authors discuss the importance of considering factors such as structural stability, material selection, and weather resistance when designing retractable roof structures. The paper emphasizes the need to use appropriate materials and design techniques to ensure the structural stability and performance of retractable roof structures under various weather conditions.

Dutta et al. [26] discussed the challenges involved in designing and analyzing membrane structures. The authors focus on the importance of considering wind and snow loads, structural stability, and membrane material selection when designing membrane structures. The paper emphasizes the need for performance-based design approaches to ensure the structural stability and performance of membrane structures under various loads and environmental conditions.

Miriom son [3] focused on the challenges involved in analyzing tensile membrane structures. The authors discuss the importance of considering factors such as load capacity, stability, and material durability when analyzing these structures. The paper highlights the need for accurate modeling and simulation techniques to ensure the structural integrity and performance of tensile membrane structures.

Amira Elnokaly et al. [27] highlighted the challenges involved in designing and analyzing sustainable tensile membrane structures. The authors focus on the importance of considering factors such as energy efficiency, material selection, and environmental impact when designing these structures. The paper emphasizes the need for sustainable design approaches to ensure that tensile membrane structures are environmentally friendly, energy-efficient, and durable (Figure 2).

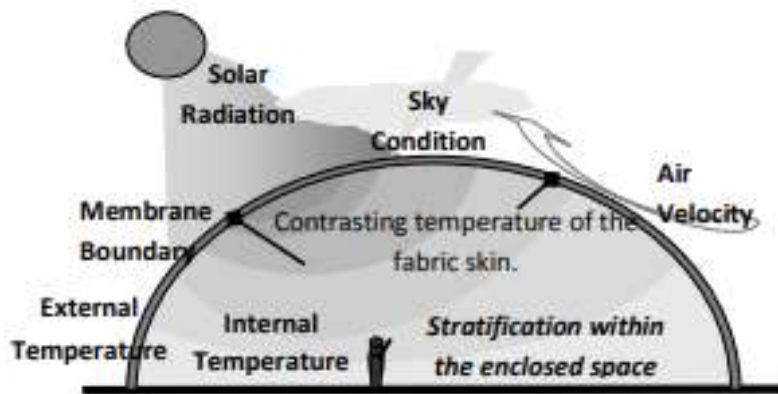


Figure 5: Stratification of air in tensile membrane enclosures

Hinkz et al. [28] focused on the challenges involved in designing tensioned membrane structures for wind loads. The authors highlight the importance of considering factors such as stability, wind resistance, and structural durability when designing these structures. The paper emphasizes the need for accurate wind load analysis and the use of appropriate design techniques to ensure the structural stability and performance of tensioned membrane structures under varying wind loads.

Bandara et al. [29] discussed the challenges involved in optimizing retractable roof structures. The authors focus on the importance of considering factors such as cost-effectiveness, functionality, and design constraints when optimizing these structures. The paper emphasizes the need for accurate modeling and simulation techniques and the use of appropriate design methods to optimize retractable roof structures for maximum functionality and cost-effectiveness.

Tang et al. [30] discussed the challenges of monitoring the structural health of tensile membrane structures. The authors highlight the importance of considering factors such as material degradation, environmental factors, and maintenance requirements when monitoring the structural health of these structures. The paper emphasizes the need for accurate and efficient structural health monitoring techniques and the use of appropriate maintenance strategies to ensure the structural integrity and durability of tensile membrane structures over their lifespan.

Akadiri et al. [31] discussed the potential future directions for research and development in membrane structure design. The authors highlight the importance of considering factors such as the use of new materials, the incorporation of smart technologies, and the development of sustainable solutions when designing membrane structures. The paper emphasizes the need for continuous innovation and improvement in membrane structure design and the importance of collaboration between researchers, designers, and manufacturers to achieve this goal. The authors propose several potential areas of future research, including the development of new materials with improved properties, the integration of advanced sensors and monitoring technologies, and the exploration of new design and construction techniques to enhance the performance and sustainability of membrane structures.

6. Conclusion

In conclusion, this review paper has highlighted the importance of adjustable roof canopies in modern architecture and provided a comprehensive overview of their design, analysis, applications, challenges, and future directions.

The review paper has shown that adjustable roof canopies offer numerous benefits in modern architecture, including enhancing the functionality, energy efficiency, and aesthetic appeal of buildings. However, the design and analysis of adjustable roof canopies face several challenges such as structural stability, material selection, and weather resistance. These challenges must be addressed to ensure the optimal performance and sustainability of adjustable roof canopies. Looking ahead, the field of adjustable roof canopies is poised for significant growth and innovation. The use of new materials, advanced sensors, and monitoring technologies, and the incorporation of smart technologies will lead to new applications and advancements in adjustable roof canopy design. The potential benefits of adjustable roof canopies for sustainable building design and urban planning are also likely to fuel the growth of this field.

In conclusion, this review paper has provided a comprehensive overview of the design, analysis, applications, challenges, and future directions of adjustable roof canopies. It is hoped that the insights provided in this paper will contribute to the continued growth and innovation of adjustable roof canopies in modern architecture.

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Effect Of Antifungal Activity Of Seaweed Extract (*Ascophyllum nodosum*) Against Soil Borne Pathogens Of Soybean

SM Chapke*, CV Ambadkar, MG Patil and VM Gholve

Department of Plant Pathology, College of Agriculture, Parbhani Vasantrya Naik Marathwada Krishi Vidyapeeth, Parbhani- 431 402 (M.S), India.

Purpose:

Presently soybean has emerged as an important oilseed crop in India.. Soil borne diseases are the most important in pulses causing heavy losses in seed yield. Most of the soil borne pathogens are difficult to control by conventional strategies such as the use of resistant cultivars and synthetic fungicides. Therefore, it is need of the day to find out cost effective and eco-friendly strategies for management of soil borne diseases of soybean.

Method:

Seaweed extract (*Ascophyllum nodosum*) against soil borne pathogen causing diseases in soybean, was evaluated *in-vitro* by applying Poisoned Food Technique and using Potato dextrose agar as basal medium. Mycelial growth of test pathogen was recorded after 24, 48, 72 and 96 hrs. Per cent inhibition over control was calculated by using formula given by Vincent (1927).

$$C - T$$

Per cent inhibition = ----- X 100

$$C$$

Where,

C= Mycelial growth in control plate

T= Mycelial growth in treated plate

Result:

The effect of different level of seaweed extract on *Fusarium oxysporum*. The results obtained, all the concentrations (250, 500, 750, 1000, 1500 and 2000 ppm) of seaweed extract showed considerable inhibition on mycelial growth of *F. oxysporum*. But, the increased concentrations of 1500 and 2000 ppm showed maximum inhibition even sixth day after incubation.

Conclusion:

Seaweed extract can be used to control the soil borne pathogens in soybean and also for seed and soil treatment which can increase production of soybean crop.

Keywords: bio control, *Ascophyllum nodosum in vitro*, inhibition

Correlation of Calcium and Magnesium Mineral Properties in inland low saline water and Pacific White Shrimp *Litopenaeus vannamei* Survival, Growth and Production

Khushbu Sharma^{1*}, Rachna Gulati², Sushma Singh¹

¹Department of Zoology and Aquaculture, ²Aquatic Animal Health Management, Chaudhary Charan Singh Haryana Agricultural University, Hisar Haryana

Purpose:

Ions are important for shrimp's metabolic processes and can affect their growth. The physiological status of crustacean is significantly affected not only by concentration of major minerals in water environment but also by their concentration ratios. The objective of this research was to analyze the effect of major mineral concentrations and their ratios on the production performance of Pacific white shrimp *Litopenaeus vannamei*.

Material and methods:

The experiment was carried out for 40 days in low saline inland water. The following treatments were tested, in triplicate calcium: magnesium in 1:1, 1:2, 1:3, and 1:4 were prepared in different salinity levels (5ppt, 10ppt, 15ppt and 20ppt). Shrimp were fed four times a day with a 40% protein diet. Observations of the changes in weight and length of shrimps were recorded weekly during study. At the end of the study period, average daily weight gain, weight gain per shrimp, specific growth rate (SGR), survival, and mortality rate were assessed.

Results:

The results on the growth performance of shrimp revealed that the 1:4 ratios of calcium and magnesium showed toxicity against *L. vannamei*. The number of live shrimps decreased in various treatments, leading to a significant decrease in shrimp weight (CD=0.47; p=0.05). The weight of shrimps was significantly lower (14.52g) in control (1:1) and it increased to 15.56, and 16.09g with an increase in calcium and magnesium ratio from 1:1-1:3 ratio. But at a ratio of 1:4 of calcium and magnesium, the weight of shrimps was significantly decreased to 14.13g. Statistical analysis revealed a significant effect of the observation period. The weight of shrimps significantly increased to 16.45g on the 40th day as compared to the initial 13.05g due to the number of live shrimps in control (CD=0.36; p=0.05). Nitrogen compounds remained within the recommended levels (TAN = 0.66 mg L⁻¹, NO₂⁻-N = 0.52 mg L⁻¹, NO₃⁻-N = 1.91 mg L⁻¹) for *L. vannamei* reared in low-salinity water. Similar result were observed in histology of shrimp gills, at high concentration (1:4), destruction of gill lamella was recorded.

Conclusion: The Ca and Mg ions were crucial for the growth and survival of *L. vannamei*. These results implied that the concentrations of Ca and Mg and their ratios were the most important factors than actual water salinity for efficient production of *L. vannamei* aquaculture.

Keywords: Calcium, Magnesium, *Litopenaeus vannamei*, Ionic ratio

Pineapple leaves as an alternative to non-biodegradable materials

Thangjam Roshini* & Sharan Madhu

Department of Clothing and Textile, Faculty of Family and Community Sciences, The Maharaja Sayajirao University of Baroda, Vadodara, Gujarat-390002, India

Purpose

Our fast changing world is now more conscious about climate change, it is also a major concern that the textile industry should be aware of the concept of positive environmental impact in the ecosystem. Textile sector comes under one of the polluting segments. This sector generates 3% of greenhouse gases worldwide. The non-biodegradable fiber such as polyester contributes to solid waste in the landfill. The natural fibers from plants such jute, hemp, ramie other crop fibers are still insufficient for the replacement of non-biodegradable materials. Therefore more production of these natural minor fibers is needed. Pineapple leaf fiber is one of the crop fibers which can be a natural resource for the utilization in an extent form of textile applications. Pineapple is one of the main agricultural farming in Manipur, India. The fruits are being exported to other parts of the country in a commendable scale. However, after harvesting the fruits leaves are contributed as a waste in the landfill. Besides this, Manipur's weavers has contributed a huge volume to the handloom practices in the field of traditional crafts.

Utilizing this wasted natural resource in textile will help in natural resource management growth as well as contribute in positive environmental impact in the global climate change. Its production, processing and export will be a favor to the livelihoods of those small-scale farmers, daily-wage workers and weavers in the state.

Methods

The methodology of the study involved 1) collection of wasted leaves from the local farm in Kangchup, Manipur, 2) Hand and machine extraction of the fiber from the collected raw material, the machine extraction was carried out at CSIR-NEIST branch laboratory in Lamphel, Manipur. 3) Testing of the extracted fiber & 4) its application in handloom weaving of Manipur.

Results

As pineapple is one of the livelihood cultivation in Manipur, utilization of this agro waste turned out to be a great opportunity in the textile domain with the views of climate change. From the study, it was found that pineapple leaf fiber has characteristics such as long white lustrous, silky appearance, good tensile strength which are much compatible for making traditional textiles of Manipur. Hence the fiber can be an alternative fiber in traditional textile weaving of Manipur. Awareness regarding the extraction was spread through a local newspaper press.

Conclusions

Incorporating this natural resource in a making textiles will be a benefit to the local people of Manipur. Pineapple is one of the main cultivations in the state. So, encouraging farmers to cultivate this plant for the fruit as well as fiber will shape a better society by giving extra income to daily wage workers & local weavers by retaining the skill and tradition of weaving. Therefore, we conclude that pineapple cultivation can be a great natural resource of fiber apart from the fruit by keeping in mind the ongoing global climate change.

Keywords

Agro-waste, greenhouse gases, non-biodegradable, textile, handloom, weaving, traditional

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Role of Information Technology towards Adaptation and Mitigation of Climate Change

T Suseela, R V Sujatha and V.Sudha vani

College of Horticulture, Dr.YSR Horticultural University, West Godavari -534 101

Purpose

Climate change adaptation processes entail the involvement and collaboration of stakeholders at the community, the sectoral, the national and the international levels. At the same time, the access, management and dissemination of knowledge and information play a crucial role in enabling networking, learning and exchange within and across those levels. Thus, ICT tools hold significant potential as enablers of change and transformation in contexts that are vulnerable to the effects of climate change and variability. Their potential ranges from supporting local livelihoods diversification, to facilitating access to learning and capacity building on adaptive actions, strengthening decision-making processes and integrating emergent and traditional adaptation knowledge, among others, to better cope with current and future climatic stress.

The fact that climate change has already occurred and will continue to occur requires a three-tier solution which focuses on mitigating further changes while monitoring and adapting to changes that have already occurred. Further, the research also examined the role of ICTs in reducing the impact of signs of climate change like floods, heat waves, frost, hurricanes and so on. Research has shown that ICTs have the potential to arrest climate change as evidenced by GeSi & EC. Europa (n.d) that "the use of ICT is predicted to reduce total global GHGs by 15% by 2020... and grow to 40% by 2050." However, it is impossible to realise the full potential of ICTs in combating climate change due the current fundamental problem with the design of the existing ICT Network Infrastructure. If this design problem is rectified, it is believed that ICT can play an immeasurable role in mitigating, adapting to and monitoring climate change. Further supporting evidence is given by Young (2007) that, ICTs are to reduce climate change in other industrial and domestic sectors through de-materialising and de-carbonising the economy.

In line with the foregoing arguments, WEF (n.d.) asserts that "The ICT industry is responsible for approximately 2% of global CO₂ emissions. ICT solutions have the potential to be an Enabler to reduce a significant part of the remaining 98% of total CO₂ emitted by non-ICT industries." From this quotation it is clear that ICTs are a tool that can be used to mitigate, monitor and adapt to climate change.

How ICTs are contributing to climate change

It imperative to know the extent to which ICTs are contributing to climate change before we can use them as a tool for combating climate change otherwise, we end drawing circles in a desert. Concerning this issue, ITU (2007) indicates that ICTs are far from innocent in contributing to climate change and the major contribution of ICTs to climate change comes from the proliferation of user devices, all of which need power and radiate heat. On this issue, WEF (n.d.) indicates, "The ICT industry is responsible for approximately 2% of global CO₂ emissions." ITU (2007) further asserts that the proliferation of users with each owning more than one digital device is another contribution of ICTs to climate change.

Role of ICTs in mitigating climate change

Information and communication technologies play an important role in significantly mitigating climate change and these technologies can be used in both developed and developing countries even though developing nations lack the much-needed information and communication technology infrastructure when it comes to mitigating climate change. On some of the solutions that can be used to mitigate climate change, Ospina and Heeks (2010) suggest the use of ICTs in controlling carbon

dioxide emissions through smart grids, dematerialization or intelligent transport systems and buildings. Dematerialisation refers to replacement of "atoms" with "bits". An example of this is the current shift under way in the market for pre-recorded movies and music away from physical distribution (such as tapes, DVDs and CDs) to online delivery (ITU, 2008). Another example of dematerialization is the shift away from paper-based to online publishing. Ospina and Heeks (2010) further assert that these strategies have focused mainly on addressing the priorities of developed countries in regards to climate change since it has already been mentioned that developing countries have poor ICT infrastructure.

Apart from the above climate change mitigation strategies, the World Economic Forum (n.d.) put forward seven contributions of ICT to mitigating climate change grouped into following three thematic areas. The first category is infrastructure innovation which focuses on reducing energy consumption and Green House gases (GHGs). The second category is behavioural change and green enablement. This category focuses on the need for global measurement and tracking of carbon reduction, as well as tools that impact positive behavioural change including software tools for measuring carbon footprint, and the use of innovative technologies and opportunities that reduce travel and transportation, such as those for virtual meetings, telecommuting, and on-line services (*e.g.*, online-learning, eHealth, eTourism, eTaxation, eBanking and e-Agriculture). The third category is energy efficiency of ICT products and solutions. This category includes adopting green computing which is basically environmentally sustainable computing. It has already been indicated that ICTs' contribution to climate change is 2 %. This contribution must be monitored because the public will judge the whole sector as environmentally unfriendly if the sector does not address its own carbon footprint. First, this would impact ICT's credibility, making it difficult to deliver on the points above. Second, the rapid increase and penetration of ICT products can, if no action is taken, result in increased energy demand (World Economic Forum, n.d.).

Global e-Sustainability Initiative (n.d.) citing The Smart2020 Report provides many good examples of transformative solutions that often help reduce emissions by 80% or more and can be used by both developing and developed countries. These solutions can fit well into the three categories suggested by World Economic Forum (n.d.) in the foregoing. However, it is important to just mention them here. The solutions are e-commerce, virtual meetings and remote working, smart grid, smart motor systems, smart buildings, smart transportation, and dematerialization.

ITU (2008) proposes mitigation strategies similar to the ones in the foregoing section in that it focuses on the role of ICTs in reducing CO₂ emissions through carbon displacement (*e.g.*, telework, dematerialisation), whereas WWF (2002) proposes the use of energy-efficient applications in "smart" telecommunications, power, transportation and services industries, among others. All these strategies are covered in the three categories proposed by the World Economic Forum (n.d.) in the foregoing section. Specific examples of some of these strategies include replace travel, especially business travel, which range from the routine (for example, e-mail, phone calls, text messaging) to the sophisticated (high-performance videoconferencing) (ITU, 2008). Other local examples include use of e-payment systems like ECOASH being used in Zimbabwe, use of internet banking, mobile commerce and so on. Some of these strategies require a change in lifestyle and attitude for them to be implemented successfully.

Role of ICTs in Climate Change Adaptation

Some of these strategies include changes in management practices, land uses and so on. These strategies should rather be reinforced by ICT based strategies described below.

The International Bank for Reconstruction and Development/The World Bank (2012) in their study in Mozambique asserts that there are four types of ICT tools, namely, Geographic

Information Systems (GIS), E-Governance, Early Warning Systems (including telemetry), and Wireless communications commonly adopted by local governments worldwide for helping their cities adapt to the effects of climate change. The International Bank for Reconstruction and Development/The World Bank (2012) further asserts that GIS and E-Governance are commonly leveraged for disaster prevention and recovery purposes, while Wireless communications and Early Warning Systems are adopted to facilitate efficient disaster warning and emergency response. Global e-Sustainability Initiative (n.d.) proposes solutions, which are not very much different from the above solutions. Some of the examples of ICT solutions for adaptation proposed by Global e-Sustainability Initiative (n.d.) include, early warning systems where ICT systems are used to provide people with warnings and information regarding threats like extreme weather events, smart planning in which ICT systems are used to improve urban and rural planning and solutions can be tested based upon their resilience, e-health where smart ICT can bring down costs for health and allow correct treatment, especially in case of pandemics and new health challenges where local knowledge might be insufficient and lastly education where ICT can help reduce costs, enable access and improve the quality of education through telecentre, use of e-learning systems, virtual lecture theatres like the ones being used.

However, Ospina and Heeks (2010) noted that as regards areas of adaptation and climate change strategies in the context of developing countries. Experiences from vulnerable communities in Asia, Africa, Latin America and the Caribbean point to the use of applications such as mobile phones, the Internet and community radio as part of climate change responses, including the strengthening of local livelihoods, natural resources management and training, access to relevant information and networking opportunities, and awareness raising, among others. Ospina and Heeks (2010) research focused on the potential of ICTs towards CO₂ emission reduction, including a variety of highly innovative applications that aim at improving energy efficiency in the telecommunications, transportation, construction and services industries, among others. It is important here to note that focus must then be shifted to adaptation rather than to mitigation only. IPCC (2007) in its report on climate change tackles the priorities of developing countries through adaptation (*i.e.*, recovery and adjustment in the face of climate change). IPCC (2007) further asserts that the potential of ICTs in adapting to climate change is now evident in use of devices like mobile phones and other applications used in adapting to climate change.

Role of ICTs Climate Change Monitoring

Information and communication technologies (including radio and telecommunication technologies, standards and supporting publications) are being used for weather forecasting, climate monitoring, predicting, detecting and mitigating the effects of natural disasters. ITU (2008) cites technologies which allow remote monitoring and data collection using ICT- equipped sensors (telemetry). In addition to that, ITU (2008) also cites aerial photography, satellite imagery, grid technology and in the use of global positioning by satellite (GPS) for tracking slow, long-term movement, for instance of glaciers or ice floes. These satellites and weather radars also track the progress of particular hurricanes and typhoons and tracking tornadoes, thunderstorms, and the effluent from volcanoes and major forest fires. Also, the radio-based meteorological aid systems collect and process weather data. It is further asserted that apart from monitoring the effects of climate change, ICTs have also proved invaluable in computer modelling of the earth's atmosphere (ITU, 2008). Further to that supercomputers are being used in meteorological services to produce complex general circulation models of climate. Further, different radio-communication systems (satellite and terrestrial) are used for dissemination of information concerning different natural and man-made disasters (ITU, 2008).

In addition to the foregoing solutions, ITU (n.d.) indicates that the role of ICTs in weather and climate monitoring is shown in the structure of the World Meteorological Organization's (WMO) World Weather Watch (WWW) and Indian Meteorological Department (IMD), which comprises three integrated core system components as follows:

The Global Observing System (GOS) which provides observations of the atmosphere and the Earth's surface (including oceans) from the globe and from outer space. The GOS uses remote sensing equipment placed on satellites, aircraft, radios and relay data to environment control centres.

The Global Telecommunication System (GTS) - radio and telecommunication networks for real-time exchange of a huge volume of data between meteorological centres.

The Global Data Processing System (GDPS) - thousands of linked mini, micro and supercomputers, processes an enormous volume of meteorological data and generates warnings and forecasts. From the above discussion, it is clear that ICTs play a major role in monitoring climate change through helping with data collection, dissemination, storage, collaboration, processing and management.

Challenges in combating climate change

The United Nations Framework Convention on Climate Change (2007) asserts that many factors contribute and compound the impacts of current climate variability in Africa and will have negative effects on the continent's ability to cope with climate change. These include poverty, illiteracy and lack of skills, weak institutions, limited infrastructure, lack of technology and information, low levels of primary education and health care, poor access to resources, low management capabilities and armed conflicts. The overexploitation of land resources including forests, increases in population, desertification and land degradation pose additional threats (UNDP 2006). Still on challenges, Economic Forum (n.d.) asserts that there remains no single, unified message that is being delivered to senior-most decision makers from governments and in other industries regarding use of ICTs in combating climate change.

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An exploratory study on Climate Change and Menopausal problems" **Gaytri Tiwari, Krushnpriya Sahoo, Sneha Jain, Hemu Rathore and Suman Singh**

Maharana Pratap University of Agriculture and Technology, Udaipur(Rajasthan)

Purpose

Men and women are known to be affected by climate change in different ways, but it is not widely known or understood how this will affect the health effects of menopause, particularly hot flashes. Given the length of the symptoms, the high proportion of women who experience them, and the repercussions that follow, any slight change in occurrence due to climate change could have a very big impact on women. Menopause is said to be a universal reproductive phenomenon, which can be perceived as unpleasant. This period is generally associated with unavoidable manifestation of aging process in women. The term “menopause” is commonly used to describe any of the changes a woman experiences either just before or after she stops menstruating, marking the end of her reproductive period. A significant risk to world health is posed by climate and environmental changes is the wide range of effects, from those on a person's interior biology to those on a society's external systems. Climate change have negative short- and long-term consequences on sexual development, fertility, pregnancy and neonatal outcomes, lactation, and menopause. The aims of the Research were to assess the menopausal problems among working and non working women.

Methods

The present study was conducted within the municipal limits of Udaipur city. The total sample for the present study consisted of 300 women (150 working and 150 non working) belonging to the age range of 40-50 years. A scale was developed by the investigator to explore the menopausal problems and was standardized by calculating validity and reliability of the scale. Wherein the items related to different categories were listed through reference work. 40 items were formulated under five categories e.g. physical/physiological problems, emotional problems, personality problems, sexual problems and urinary/digestive problems were formulated to measure the menopausal problems. The reliability value for the scale is 0.89.

An individual with score of 129-160 may be considered to have a very severe of menopausal problems. Score ranging from 97-128 represents severe menopausal problems. The score from 64-96 represents moderate problems. The mild score i.e. 32-63 where as a score of 0-31 represents none or no severity of menopausal problems. Percentages were computed for each part as well as for working and non working. Comparison between groups was calculated by applying ‘t’ test.

Results

Menopausal problems among subjects

Majority (69.13 %) of working women had severe problems followed by moderate (24.83 %) and mild (6.04 %).

Majority (74.11 %) of non working women had moderate problems followed by mild (13.36 %) and severe (12.53 %).

In general, total population shows that almost one third (73.07 %) had severe problem followed by moderate (15.61 %) and severe (11.32 %).

Comparison of menopausal problems among working and non working women

Mean value depicted that problems were more among working women than non working women. t-value was also indicating that menopausal problems among working and non working was statistically significant (at 0.05 %).

Conclusions

Majority of working women had severe problems followed by moderate and mild whereas majority of non working women had moderate problems. Comparison of menopausal problems among working and non working women depicted that problems were more among working women than non working women. t-value was also indicating that menopausal problems among working and non working was found statistically significant (at 0.05 %).

Women are exposed to more climate changes, which causes ovarian function to diminish and menopause to occur early menopause It's interesting to note that climate change may also affect menopause by making symptoms, notably hot flashes, mood swings worse and lasting longer.

Keywords: Menopause, Problems, physical/physiological problems, emotional problems, personality problems, sexual problems and urinary/digestive problems

Assessment Of Physico-Chemical Characteristics of Bio-Fertilizers Obtained From Discarded Fabrics

Jaymala Dave¹, Thodeti Manasa¹ and Sudha Babel²

¹*Department of Textile and Apparel Designing, College of Community & Applied Sciences, MPUAT, Udaipur, Rajasthan.*

²*Department of Resource Management & Consumer Science, College of Community & Applied Sciences, MPUAT, Udaipur, Rajasthan.*

³*Department of Textile and Apparel Designing, College of Community & Applied Sciences, MPUAT, Udaipur, Rajasthan.*

Purpose

Discarded fabrics originated from both domestic and industrial sectors. With the expansion of clothing and textile industries, the problem of waste disposal has become more prominent issue. In current scenario, open dumping and incineration are the main practices of waste disposal collected from industries. The foremost problem associated with open dumping is surface and groundwater contamination due to formation of leach ate as it decomposes. Keeping this in view, the present research was undertaken to develop biodegradation techniques of discarded natural fabrics to develop bio-fertilizers.

METHODS:

Six treatments (T1C1, T2C2, T3C3, T4S1, T5S2 and T6S3) were applied to cotton and silk discarded fabrics for standardization procedure. During this process physico-chemical parameters i.e. temperature, pH, relative humidity (RH) was measured at an interval of 10 days.

RESULTS:

Result revealed that in case cotton discarded fabric, treatment number T3C3 with cow dung at a ratio of 1:10 was found to be most suitable for the development of bio-fertilizers whereas treatment

number T5S2 with cow dung concentration of 1:20 was best suited to the production of bio-fertilizers.

CONCLUSION:

It can be concluded the bio-fertilizer obtained from these discarded fabric can also be used as an organic fertilizer for the cultivation of ornamental plants. The developed bio-fertilizers were observed to be good quality in terms of color, odor, general appearance, fineness, absence of fungi, earthworms' activities, decomposition of fabrics and overall quality.

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Evaluation Of Critical Temperature For Pollen Germination In Selectively Fertilized Coconut Hybrid

Afna mol O.P, Roy Stephen

College of Agriculture Vellayani

Purpose

Cocos nucifera (2n=32) is an important tropical plant species and is benevolent provider of the basic needs of millions of people. Coconut is regularly exposed to soil and atmospheric water deficit due to the fact that, it is a perennial palm with an extended effective life span. Drought is one of the important abiotic stresses which can limit the crop growth and yield by altering various physiological and biochemical processes. Selective fertilization is a method used for developing hybrids, involves artificially applying particular selection pressure during the event of pollen germination and fertilization. In the present study evaluation of critical temperature for pollen germination in selectively fertilized coconut hybrids (Kerasree Selectively fertilized and Keraganga selectively fertilized hybrids) developed by identifying critical water potential were done for assessing the temperature tolerance of the palm.

Methods

Male flowers collected from the selectively fertilized palm along with their normal hybrids and WCT were dusted in the standardized pollen germination medium in a Petri plate and kept for incubation for 3 hours at different temperature ranging from 35-45⁰C. After incubation period Pollen germination was recorded using DLMS Leica microscope and critical temperature for germination of pollen grain were identified.

Results

Kerasree selectively fertilized hybrid reported highest critical temperature for pollen germination was 44⁰C followed by keraganga selectively fertilized hybrid and WCT (42 ⁰C). Lowest critical temperature for pollen germination was observed in keraganga normal hybrids (39 ⁰C) with 27 % of pollen germination at that temperature. Both selectively fertilized hybrids of kerasree and keraganga performed better than their normal hybrids.

Conclusion

Both type of selectively fertilized hybrids evaluated for temperature tolerance in this study were found superior to their normal hybrids in retaining maximum critical temperature. This shows that selectively fertilized hybrids developed through critical water potential have positive impact on

drought tolerance. Hence efficacy of the screening technique like selective fertilization is manifested, which offers great outlook for drought tolerance breeding in perennials.

Climate change Impact and people's perception and adaptative strategies in hill farming system of himalayan region

Divya Shivani

DSB Campus, Kumaun University, Nainital

Introduction

Himalaya is the home of more than 50 million people in India and contribute significantly in the socio-cultural and economic wellbeing of the communities residing in the region. Even though climate change is a global concern but the rapidly changing climate of Himalaya has possessed a serious threat on agriculture, livelihood and food security, natural ecosystem, glacier retreat, water supply and overall wellbeing of humans. The impact of climate change is not same across the entire Himalayas but have spatial variation. Thus its important to explore and access the possible dimensions of climate change at local level in Himalayan region. Objective

To explore the changes in climatic variables.

Perception and traditional knowledge of local farming communities about changing climate. As local belief system is of utmost significance in order to adopt suitable technique to combat and mitigate the impact of climate change in the hilly tracts of Himalayas.

Methodology

The study is based on independent interviews of 120 household in Ramnagar block of Nainital district which provide insight of locals perception on climatic variations and beliefs for suitable adaptation technique for climate change.

Result

local communities in Himayas are experiencing the changing patterns of precipitation and temperature thus well aware of climate change and its ongoing impact on their livelihood and life. Thus it is important to integrate the traditional knowledge of local communities with current policies to climate change adaptation and food and livelihood security in Himlayas.

Conclusion

The local belief system of hill area communities are crucial for climate change adaptation and the role of traditional knowledge cannot be denied to mitigate the impact of changing climate in Himalayan areas for the wellbeing of local communities.

Keyword

Hill farming, climate change, Hilly farming communities, Traditional knowledge and adaptation.

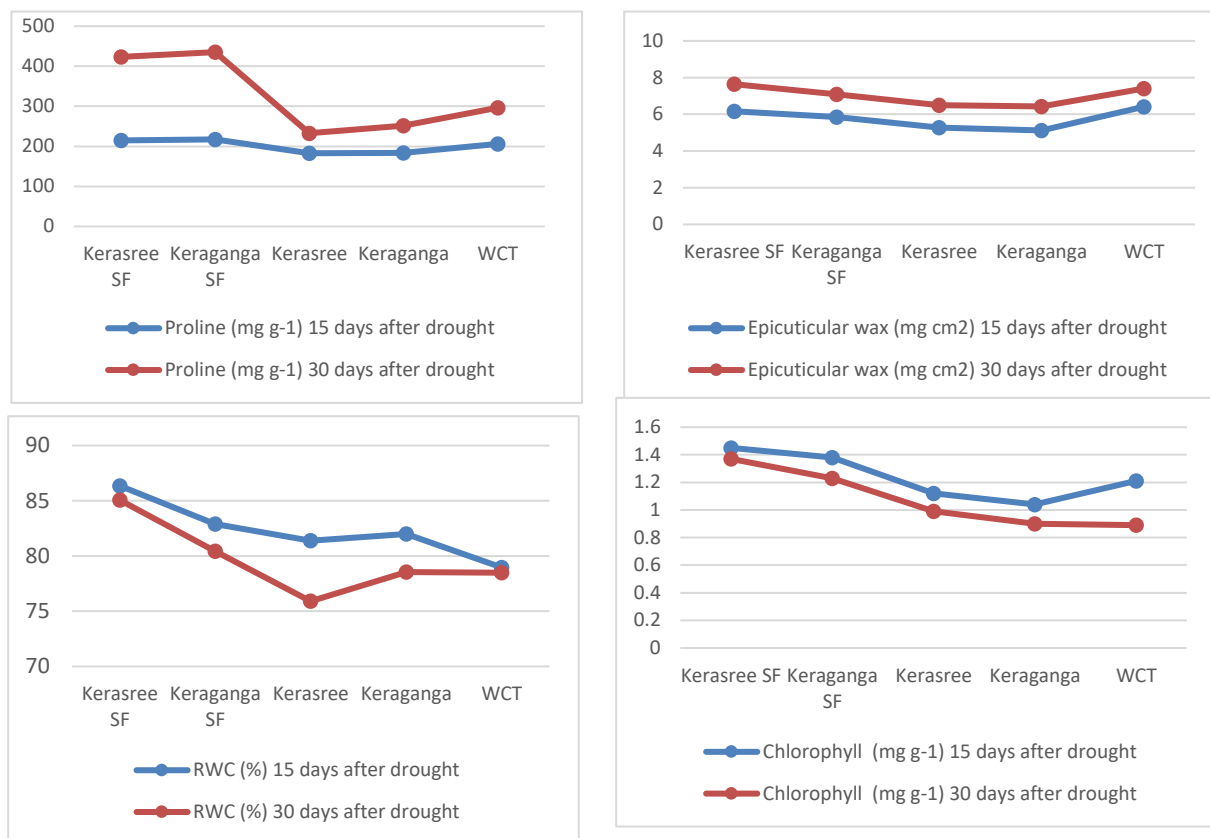


Figure 1. Impact of drought stress on proline, epicuticular wax, relative water content and chlorophyll content of selectively fertilized hybrid

Entrepreneurship development in the field of renewable energy technologies

S. R. Kalbande, Rinju Lukose, Prajakta Phadtare

Department of Unconventional Energy Sources and Electrical Engineering, Dr. PDKV, Akola - 444104, India

Purpose

Renewable energy sources are having great potential to mitigate global climate change, address environmental concerns, reduce poverty and increase energy security leading to energy independence. The Indian renewable energy sector is the fourth global position for overall installed energy capacity. The use of renewable energy sources not only saves the valuable high-grade energy, but also decreases the rate of exhaustion of fossil fuels. It also improves the nation's economy as investment in the renewable energy technologies may cost less compared to efforts required to fulfil the increased demand of fuel supply in future.

Methods

Renewable energy systems include different energy sources such as solar, wind, biomass and geothermal. The study covered the current energy status, different renewable energy technologies, its operation and various job opportunities under renewable energy sector.

Results

Renewable energy is easily and quickly accessible to society, the domain needs an introduction of new ideas, energy, quick action and some amount of adventuresome nature and this can be naturally expected from business minds. This demand when coupled with the right direction, innovative thinking and entrepreneurial spirit, it will do wonders for redefine the renewable power industry.

Conclusions

Renewable energy is the one of the most effective energy-generation techniques without affecting environment and hence promote green entrepreneurship.

Keywords: Entrepreneurship, renewable energy, business

Isolation, Identification and pathogenicity of fruit rots causing fungi associated with brinjal Dhere D. S., Suryawanshi A. P. and Patait Neha* N.

Department of Plant Pathology, College of Agriculture, Parbhani

Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani-431 402 (M.S.), India

Purpose

Brinjal (*Solanum melongena* L.) fruit rots caused by *Phomopsis vexans*, *Alternaria alternata*, *Colletotrichum capsici* and *Aspergillus flavus* are most widely distributed and destructive diseases of brinjal, causing about 20-60 per cent yield losses. Therefore, considering widespread occurrence of the fungi causing fruit rots of brinjal and inflicting qualitative as well as quantitative losses, the present studies were planned.

Methods

The brinjal fruits exhibiting typical fruit rotting symptoms were collected from farmer's field and local market and subjected to tissue by applying hyphal-tip isolation technique on PDA plates yielded characteristic growth of the pathogenic fungi viz., *Phomopsis vexans*, *Alternaria alternata*, *Colletotrichum capsici* and *Aspergillus flavus*. Pathogenicity of these test fungi were proved separately, by applying pin-prick and cotton swab / plug fruit inoculation techniques. However, only pin-pricking could reveal pathogenic association of the test fungi with brinjal fruit rots. The identification of test fungi was done based on symptomatology, pathogenicity test, morpho-cultural characteristics and microscopic observations the fungi and further confirmed by comparing with their authentic description.

Results

Pathogenic association of the test fungi causing brinjal fruit rots was assessed, based on the traits such as incubation periods, lesion size, per cent association frequency of the test fungi and fruit area affected (%). The results revealed that the *P. vexans* exhibited least incubation period (5 days), maximum fruit lesion size (4.97 mm), maximum fruit area affected (28.40%), and highest association frequency (94.66%). This was followed by *A. alternata* (7 days, 3.90 mm, 26.66% and 83.33%), respectively and *C. capsici* (8 days, 2.88 mm, 15.00% and 58.66%, respectively). Whereas, *A. flavus* didn't showed any apparent symptoms.

Conclusions

It is concluded that the all test fungi exhibited pathogenic nature, but among that based on symptomatology and pathogenic tests/ traits *P. vexans* and *A. alternata* were selected as major pathogenic fungi, causing brinjal fruit rots.

Keywords: (Pathogenicity, *Phomopsis vexans*, *Alternaria alternata*, *Colletotrichum capsici* and *Aspergillus flavus*)

Change Detection In Land Use Land Cover Of Chincholi Taluk Using Remote Sensing And Gis

¹Basanti Patil , ²Dr Ramesh Londonkar

¹Department of Environmental Science Gulbarga University, kalaburagi, Karnataka-585104(IN)

²Department of Biotechnology Gulbarga University Kalaburagi, Karnataka--585104(IN)

Introduction

Land Use Land Cover (LULC) Change Detection is an important process for analyzing and monitoring the changes in land use and land cover over a period of time. The process involves the use of Remote Sensing and GIS techniques to acquire, process, and analyze satellite imagery to create LULC maps for different periods. These maps are then compared to detect any changes that have occurred. LULC Change Detection is a valuable tool for studying the impact of human activities on the environment and for managing natural resources. It is widely used in various fields, including agriculture, forestry, urban planning, and environmental management. Remote Sensing and GIS are the key technologies used in LULC Change Detection. Remote Sensing involves the use of satellite imagery to collect data about the Earth's surface, while GIS is used to manage and analyze this data. These technologies have revolutionized the way we study and manage our environment, providing accurate and timely information for decision-making processes. In this process, the accuracy of the results is crucial, and it is important to use appropriate techniques and methods for data acquisition, image processing, and analysis. The accuracy of the results can be validated through fieldwork, ground truth data collection, and accuracy assessment. Overall, LULC Change Detection using Remote Sensing and GIS is an important tool for studying and monitoring land use changes, managing natural resources, and supporting decision-making processes in various field.

Objective:

To generate and compare the satellite image of Chincholi Taluk for a decade from 2009-2019

Methodology

The materials and methodology used in a study on LULC change detection using Remote Sensing and GIS techniques typically include the following steps:

Data Acquisition: The study requires obtaining satellite imagery LISS 3 for the study area and time period of interest.

Data Pre-processing: The raw satellite data is processed to remove errors, noise, and cloud cover. This involves atmospheric correction, radiometric calibration, and image enhancement.

Image Registration: The processed images are registered or aligned spatially to ensure that they are aligned to the same geographic location.

Image Classification: The study uses supervised or unsupervised classification algorithms to classify the satellite images into different LULC classes. These classes can include forest, agriculture, water bodies, bare soil, urban areas, and mining areas.

Accuracy Assessment: The accuracy of the LULC classification is assessed using ground truth data, such as field surveys, aerial photography, or other reliable sources.

Change Detection Analysis: The LULC maps for different time periods are compared to identify and quantify changes that have occurred in the study area. This includes identifying areas where there has been a change in land use or land cover, and the magnitude of these changes.

Data Analysis: The study analyzes the data to identify the drivers of change, such as human activities, natural factors, or a combination of both.

Results and Discussion: The study presents the results and discusses the implications of the findings for land use planning and management.

RESULT:

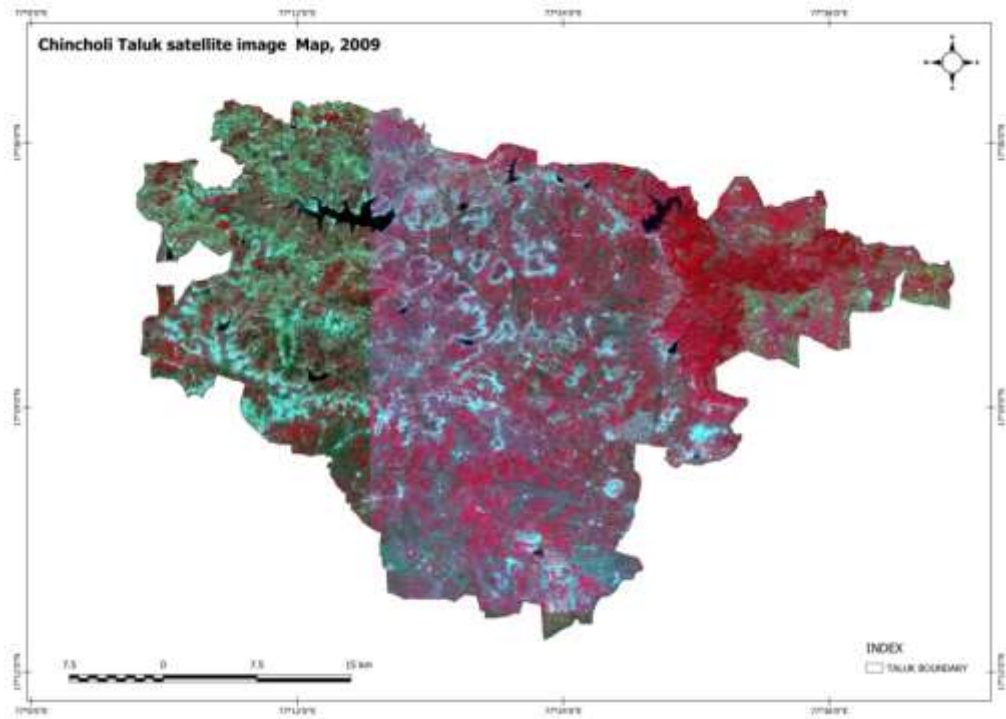


Figure 2: LISS 3 satellite imagery 2009

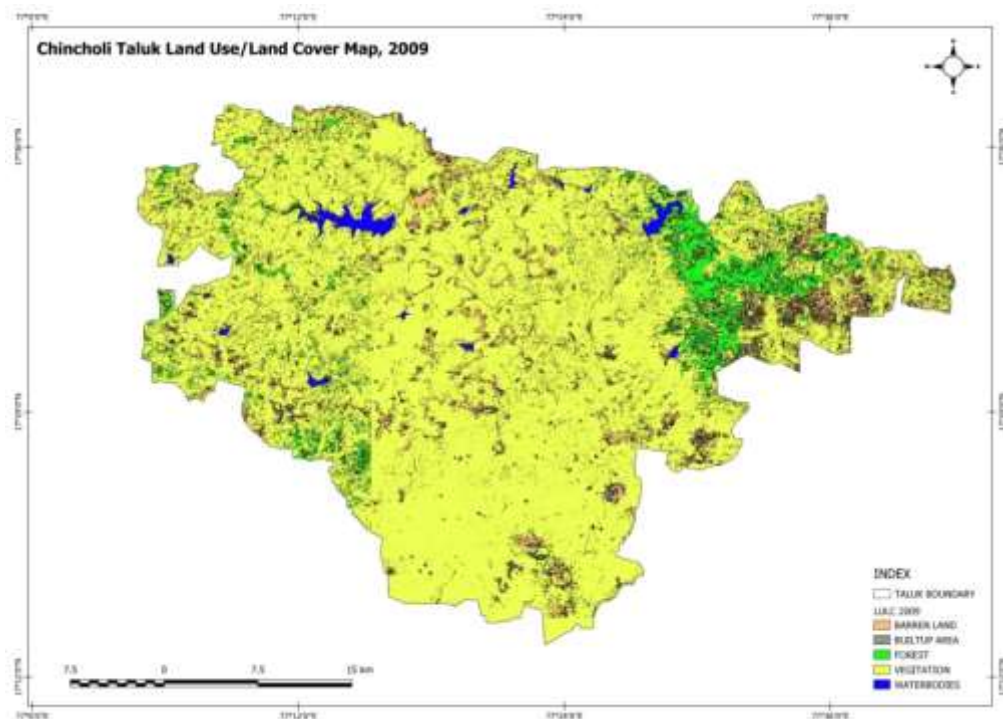


Figure 3: Land use /land cover map 2009

Table 1: Land use Land cover classification and its changes 2009

2009 CHINCHOLI LULC			
S.NO	LULC	AREA (Square KMS)	% COVERED
1	Barren land	155.06	10.04%
2	Builtup land	22.26	1.44%
3	Forest	158	10.23%
4	Agriculture land	1192	77.15%
5	Waterbodies	17.7	1.15%
TOTAL		1545.02	100.00%

According to the analysis of the 2009 Liss3 image, Chincholi taluk had a total land area of approximately 1525.02 square kilometers, with various land use categories. The largest land use category in Chincholi taluk was agriculture land, covering 1192 square kilometers (77.15 %). This suggests that agriculture was a major activity in the taluk at that time, and was likely a significant source of livelihood for its residents.

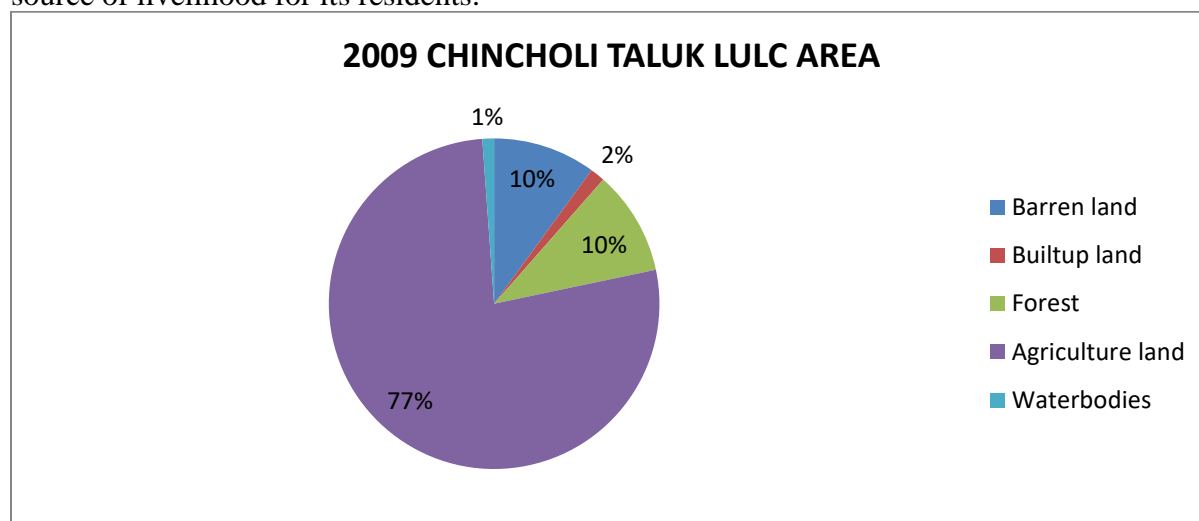


Figure 4: Pie chart showing the LU/LC area covered

Forests covered 158 square kilometers (10.23 %) of the taluk, indicating the presence of a significant amount of natural vegetation in the area. This is important for biodiversity conservation and as a source of resources for the local community. Water bodies, which included rivers, lakes, and other bodies of water, covered 17.7 square kilometers (1.15%) of the taluk.

These were important for irrigation, drinking water, and other uses. Barren land covered 155.06 square kilometers (10.04%), indicating a significant amount of unproductive land in the taluk. This land may have been unsuitable for agriculture or other uses due to factors such as poor soil quality, topography, or other environmental conditions. Built-up land covered only 2.26 square kilometers (1.44%), suggesting that urbanization and industrialization had not had a major impact on the landscape of Chincholi taluk at that time.

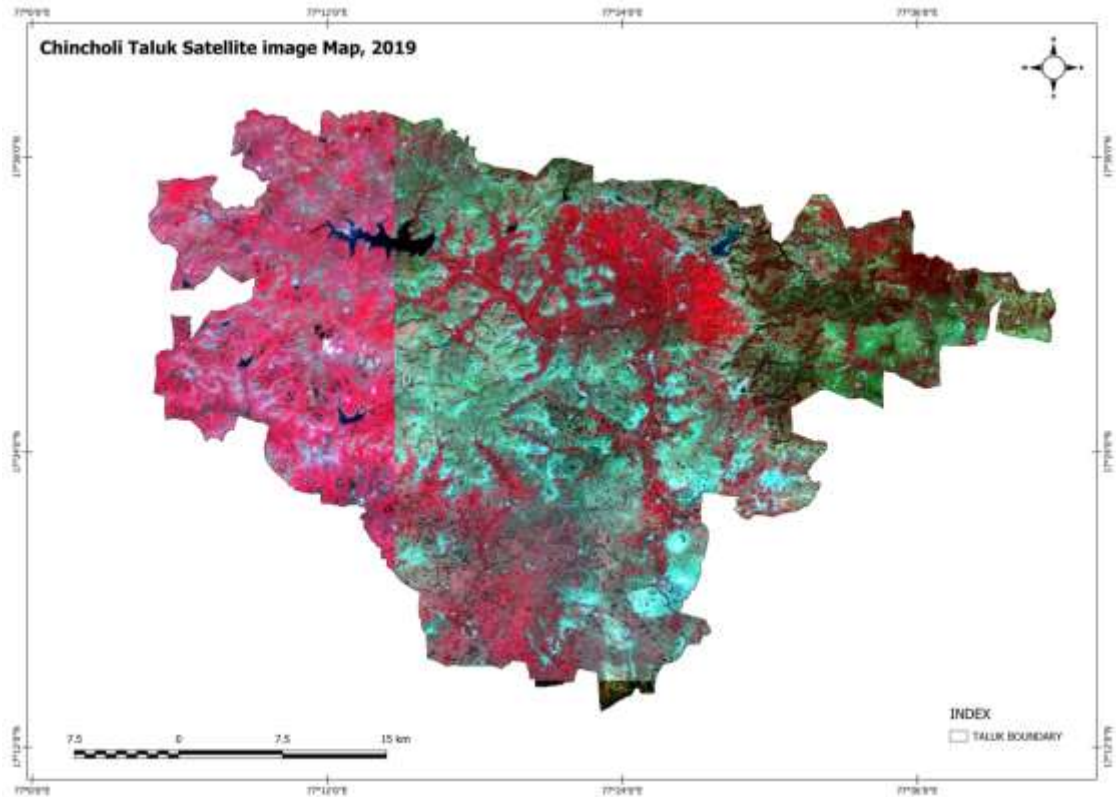


Figure 5: LISS 3 satellite imagery 2019

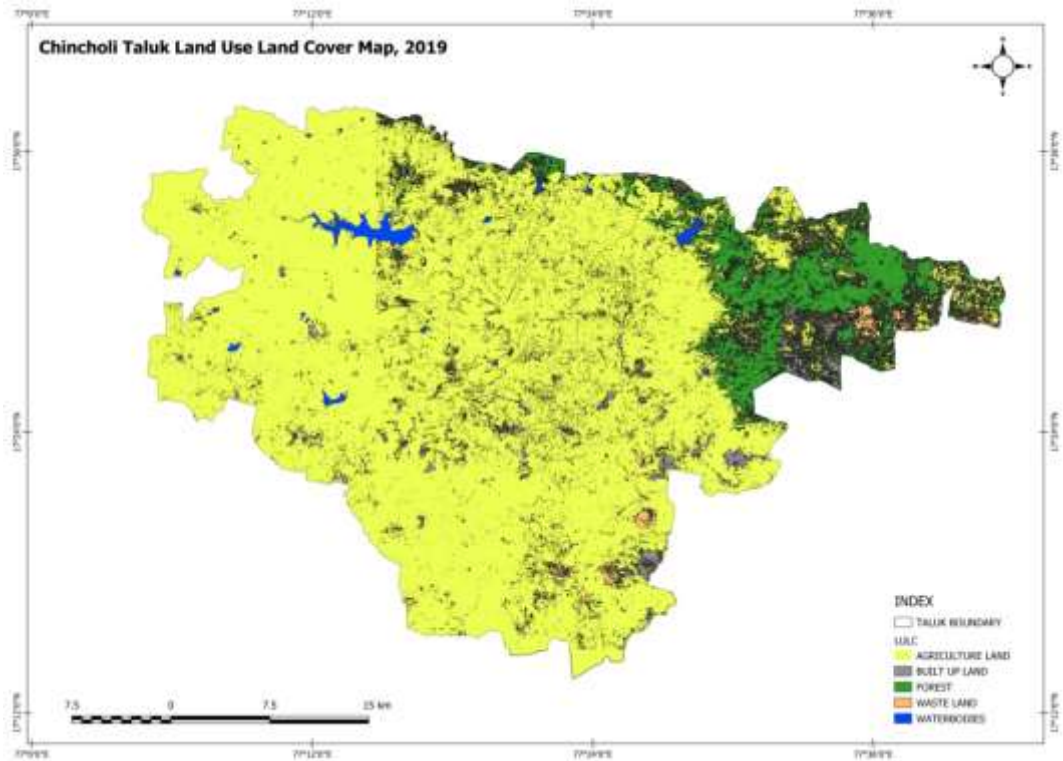


Figure 6: Land use /Land cover map 2019

Table 2: Land use Land cover classification and its changes 2019

2019 CHINCHOLI LULC			
S.NO	LULC	AREA (Square KMS)	% COVERED
1	Barren land	75	4.85%
2	Builtup land	89	5.76%
3	Forest	174.49	11.29%
4	Agriculture land	1192	77.13%
5	Waterbodies	15	0.97%
TOTAL		1545.49	100.00%

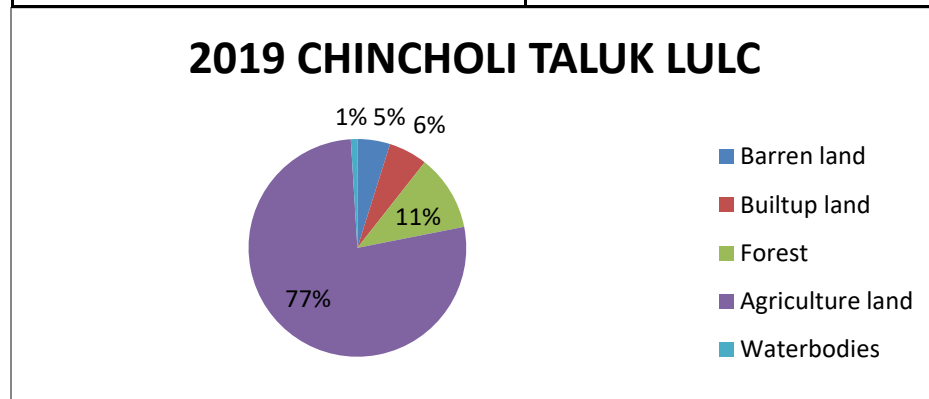


Figure 7: Pie chart showing the LU/LC area covered

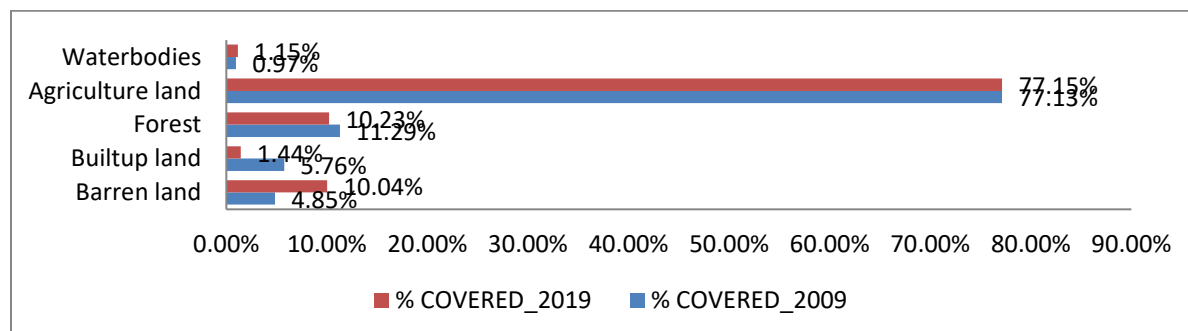


Figure 8: Land use Land cover classification and its changes 2009 and 2019

Conclusion

A change detection analysis was conducted by comparing the LULC maps generated from the 2009 and 2019 Liss3 satellite images of Chincholi taluk. The aim of the analysis was to identify and quantify changes in the land use patterns in the taluk over the past decade.

The change detection map generated as a result of the analysis provides a visual representation of the changes that have occurred in the land use patterns of Chincholi taluk over the past decade. The map shows the areas where land use changes have occurred, and can be used to identify the drivers of these changes.

This change in LULC can be attributed to various factors such as urbanization, population growth, agricultural practices, and climate change. The increase in built-up land may be due to urbanization and population growth, while the decrease in barren land may be due to afforestation efforts or land reclamation projects. The decrease in water bodies may be due to natural factors such as drought or human factors such as overuse or pollution.

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Effect of terminal heat stress on productivity and physiology of different bread wheat (*Triticum aestivum* L.) genotypes

Namitha Elizabeth^{1*}, V.L. Gawande², Swati G. Bharad³

¹ *Department of Genetics and Plant Breeding,* ² *Pulses Research Unit,* ³ *Wheat Research Unit, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra-444104, India.*

Purpose

Wheat is a thermosensitive, long-day crop that is best adapted to temperate climates. However, it is primarily cultivated in tropical and subtropical regions of the world, where it is exposed to high temperatures during certain physiological stages of crop growth, especially anthesis and grain filling. Rising temperatures can cause early flowering and shorten the grain-filling period, reducing crop duration and ultimately lowering yields. The objective of the study is to evaluate the physiological parameters contributing to heat stress tolerance in bread wheat.

Methods

64 genotypes of wheat including 14 parents and 48 crosses along with two checks were grown under timely and late sown condition to evaluate the influence of physiological parameters such as canopy temperature depression, relative water content and proline content in relation to heat stress tolerance.

Results

The three parameters studied were found to have a significant influence in determining the yield under heat stress conditions. The tolerant genotypes were found to show a relatively lesser reduction in yield under heat stress as compared to the susceptible ones.

Conclusion

The tolerant genotypes identified from the study can be used in further breeding programs. The knowledge of differential performance of various traits related to heat tolerance, its association and intensity of association can be used to generate valuable information about the role of various traits imparting heat tolerance and thus aid to develop improved varieties for late sowing conditions

Keywords Wheat, heat stress, canopy temperature depression, proline content, relative water content

Stingless bee, *Tetragonula iridipennis* as a pollinator in capsicum under protected cultivation
Rakshitha T. N., Prabhu S. T., Dileep Kumar N. T., Sahana M. and Saleem Kannihalli

Department of Agricultural Entomology, College of Agriculture, University of Agricultural Sciences, Dharwad, Karnataka, India- 580005.

Purpose

Agricultural practices gradually evolved to rise the production and productivity of crops without expanding the area. One of the technologies to cope up with change in climatic condition is protected cultivation. The growth of protected cultivation in the world has driven crops from open field to protected environments, but this condition creates a physical barrier which prevents the access of natural pollinators to flowers. The most promising pollinator seems to be the stingless bees belonging to the super family Apoidea, family Apidae and sub family Meliponinae, because they have stunted vestigial sting that makes them safe for workers to carryout daily cultural practices in the confined environment.

Methods

The present study was carried out in greenhouses of Hi-tech Horticulture unit, Saidapur farm, University of Agricultural Sciences, Dharwad, Karnataka, India to know the efficiency of stingless bee, *Tetragonula iridipennis* Smith on pollination of capsicum crop cultivated under greenhouses during two seasons, summer (2021) and *rabi* (2021-2022). At the time of flower initiation three stingless bee colonies were introduced inside the greenhouse.

Results

The activity of foragers started at 07:00 h and continued up to 18:00 h with peak activity at 11.00 h to 12.00 h (12.90 bees/m²/10 min) during summer. In *rabi*, activity of bees started from 07:00 h till 18:00 h with peak activity at 11:00 h to 12:00 h (11.35 bees/m²/10 min). The floral handling time of stingless bees on flower in both the seasons, irrespective of the hours in a day the maximum flower handling time was observed in the afternoon hours (44.60 s/flower) compared to forenoon hours (20.57 s/flower). Even in often cross pollinated capsicum significant increase in number of fruits/plant (10.40 and 8.98), percentage of fruit set (90.04 % and 81.86 %), yield/plant (0.71 g and 0.46 g), fruit length (7.38 mm and 6.50 mm), fruit girth (22.86 mm and 19.43 mm), fruit weight (98.38 g and 83.08 g), TSS (5.20 % and 4.52 %), ascorbic content (93.64 mg/100 g and 89.15 mg/100 g) and moisture content (95.37 % and 40.93 %) was recorded between bee pollinated and control plots, respectively.

Conclusion

Stingless bees have contributed to crop pollination via increasing the yield and enhancing the quality of fruits. Despite of high selfing rates in capsicum, self-pollination led to inbreeding depression so, outcrossing with stingless bees, ameliorate fruit set and fruit quality under protected condition.

Keywords: Stingless bee, Capsicum, Foragers, Activity, Nectar, Pollen

Evaluation of *Paecilomyces tenuis* producing Huperzine A for the management of root-knot nematode *Meloidogyne incognita* (Nematoda: Meloidogynidae)

Rami Kassam · Virendra S. Rana · Aditi Kundu · Gautam Chawla · Uma Rao

Purpose

Root-knot nematodes (*Meloidogyne* spp.) are notorious plant-parasitic nematodes that affect agricultural crops. These obligate soil-dwelling parasites typically maneuver the host plant

physiology by forming specialized feeding cells resulting in heavy yield losses. Scant management tools are available to effectively combat this pest.

Methods

In an exploratory attempt of identifying new fungal biocontrol agent(s) for *M. incognita* from India, a *Paecilomyces tenuis* isolate from rhizosphere soil was found to incur > 90% mortality of the infective second-stage juveniles (J2s) at 24 h post-exposure to the fungal filtrate with about 87% parasitization. The fungal filtrate also significantly reduced the egg hatching and host-root penetration of *M. incognita* under in vitro and in vivo conditions revealing its effectiveness in curbing nematode pathogenicity with positive effects on plant growth.

Results

A quantitative nature of resistance to *Fop*, ranging from highly to partially resistant and susceptible accessions was detected, with resistance being the most frequent phenotype. Diverse colonization patterns were observed, suggesting the existence of different resistance mechanisms. In the highly resistant accessions, absence of fungal colonization in the vascular tissue was detected, while fungal progression was arrested at the level of roots both in highly resistant and partially resistant accessions. Chromatographic analyses revealed the presence of Huperzine A (433.56 mg L⁻¹) in the *P. tenuis* isolate.

Besides, the isolate possessed acetylcholinesterase inhibition attribute with an IC₅₀ of 2.85 ± 0.12 mg mL⁻¹ of the fungal filtrate. Further, GC-MS analysis revealed the production of other nematicidal compounds by the fungus including acetic acid. To conceptualize the mode of nematicidal action, RNA-Seq was done post-treatment of the *M. incognita* J2s and model worm *Caenorhabditis elegans* with fungal filtrate and pure Huperzine A. The transcriptomic profile unravelled the molecular intricacies underlying the nematicidal action affecting several biological pathways and developmental checkpoints of the nematode.

Conclusions

Thus, the *P. tenuis* isolate offers significant potential to be used as a biocontrol agent against *M. incognita* along with its commercial use for Huperzine A production

Keywords: Acetylcholinesterase · Biocontrol · Huperzine A · *Meloidogyne* · *Paecilomyces tenuis* · Nematicidal

Standardization of *in vitro* regeneration protocol in *Chrysanthemum coronarium* L. using leaf as explant

Pooja A., Panwar Sapna, Tiwari A. K., Kumar Gunjeet

Division of floriculture and Landscaping, IARI, New Delhi-110012

Purpose

Chrysanthemum coronarium L. is an annual herbaceous crop. The flowers have economic importance on account of their varied uses such as cut flowers for vase decorations, loose flowers for making garlands and religious functions. It is highly cross pollinated and propagated by seed. The seed-to-seed cycle of garland chrysanthemum takes 5–6 months and each plant produce 5–6 g of seed (300 seeds/g). However, plants raised from seeds shows variation due to high heterozygosity. Micropropagation is one of the viable approaches for large scale multiplication and to fulfil the increasing demand of quality planting material of *C. coronarium*. This method is free of seasonal bounds and enables manifold multiplication of selected variety.

Methods

Leaf segments (0.25 cm²) were collected from *in vitro* produced plantlets which are three weeks old and cultured *in vitro* containing half strength MS medium (Murashige and Skoog medium), 30 g/l sucrose, 7.0 g/l agar powder as basal medium containing BAP, NAA and Kinetin at different concentrations.

Results

Half strength MS medium supplemented with BAP (0.5 mg/l) and NAA (1.0 mg/l) resulted in the highest micro shoot survival (86.67%) and shoot regeneration (82.79%). Thick shoots (5.78 cm) with dark green leaves were observed in half strength MS media supplemented with GA₃ (0.5 mg/l) as well as the treatment including half-strength MS basal medium supplemented with NAA (0.5 mg/l) exhibited highest rooting (90.0%). The newly regenerated plantlets exhibited the highest plant survival (76.60%) on medium containing cocopeat, perlite, and vermiculite (1:1:1) enriched with half strength MS inorganic broth.

Conclusion

The current study established *in vitro* regeneration protocol for producing true to type plants which are otherwise difficult in the species. This protocol may help for large scale multiplication of desired types to fulfil the demand of quality planting material of *C. coronarium*.

Keywords: *Chrysanthemum coronarium*, growth regulators, rooting, acclimatization

Assesment Of Different Wheat Establishment Methods For Adapting Terminal Heat Stress In Central Zone Of Punjab

O S Sandhu*, S K Kataria and Baljeet Kaur

Krishi Vigyan Kendra, Jalandhar, Punjab Agricultural University, Ludhiana, Punjab, India

Purpose

Heat stress is one of the major constraints for wheat (*Triticum aestivum*) growth and development and an alarming threat to wheat in Punjab, India. It is evident that the retaining paddy residue in field is the measures to manage terminal heat stress and improve productivity in wheat.

Methods

To assess the influence of different crop establishment methods on wheat productivity and to combat with terminal heat stress, a survey-based study of 90 farmers was conducted to compare relative performance of different wheat establishment methods during Rabi 2021-22 in district Jalandhar, Punjab, India. In view of these two methods of wheat establishment i.e sowing of wheat with happy seeder (HS, rice residue retained at surface) and sowing of wheat with super seeder (SS, rice residue incorporated into the soil) were compared with the conventional method of wheat sowing (CW, rice residue burnt in the field followed by tillage operations).

Results

The results indicated, the average ear length and average grains per ear were not significantly affected with the crop establishment method, but test weight (1000 grain weight) was recorded significantly higher under HS (40.60) sown wheat as compared to the SS (40.35) and CW (38.67). Similarly, significantly higher grain yield was recorded under HS (42.25 q ha⁻¹) and SS (41.88 q ha⁻¹) sown wh.at compared to the CW (40.75 q ha⁻¹).

Conclusions

The results revealed the potential of HS technology to substantially enhance the crop productivity & profitability, and to combat with terminal heat stress, besides providing a better livelihood option for farmers.

Keywords: happy seeder, terminal, heat stress, wheat, yield

Characterization of papaya ring spot (PRSV) and papaya leaf curl (PaLCuV) viruses infecting papaya, epidemiology and management of PRSV disease**PREMCHAND U and Raghavendra K. Mesta***Department of Plant Pathology, College of Horticulture, Bagalkot, University of Horticultural Sciences, Bagalkot, 587104, India***Purpose**

Carica papaya L. is the commercially cultivated species and most economically important fruit crop of the tropical and subtropical regions of the world. The importance of papaya in the world's economy is demonstrated by its wide distribution and substantial production in tropical countries. India is the largest and leading producer of papaya in the world which shares 44.04 per cent of global production. Besides these papaya viruses cause diseases of global significance with serious damage in fruit production as well as the devastation of the entire crop. These PRSV and PaLCuV diseases are major limiting biotic factors for papaya production in India. Therefore, considering the research work conducted in India so far and existing research gap, present study has been undertaken pertaining to the prevalence of disease, characterization of viruses, the host range of the virus, epidemiological studies and development of management approaches. The present research work was carried out

Methods

An intensive roving survey was carried out during 2019-20 and 2020-21 in 10 major papaya growing districts of Karnataka, India to determine the prevalence and distribution of PRSD and PaLCuV. Meanwhile, during the survey, 74 PRSV and 32 PaLCuV infected symptomatic leaf samples exhibiting various kinds of symptoms were collected from naturally infected papaya plants from surveyed location. Further, RNA and DNA isolation, detection, characterization and sequencing of PRSV and PaLCuV, respectively. In addition, PRSV and PaLCuV complete genome comparison, phylogenetic and recombination analysis was done using different online software's. Determining the effect of different months of planting on the incidence of PRSV disease, growth and yield parameters of papaya at different stages of growth and Identification of susceptible stage of papaya for PRSV infection was studied. Further, integrated management of PRSV disease under field conditions were conducted over two consecutive years (2019-20 and 2020-21) to assess the effect of insecticides and biorationals (plant-based oils and seaweed extract) against PRSD. Further, using the effective treatment(s) from the above experiment(s), three integrated disease management (IDM) modules were designed for the management of PRSD on papaya and evaluated along with the recommended dose of POP of the UHS, Bagalkot, Karnataka, India as check.

Results

The roving survey carried during 2019 to 2021 in major papaya growing districts of Karnataka revealed that PRSV disease incidence ranged from 50.5-100 %. The 107 samples collected from 75 locations during survey were subjected to PCR based detection. Among them, 75 samples were tested positive for PRSV infection and the remaining 32 for PaLCuV (monopartite begomovirus).

Complete genome characterization of a representative PRSV-BGK (Collected from Bagalkot) isolate revealed that this isolate contains 10,341 nt with ten mature polyproteins and is demarcated as a variant. It is given a descriptor as PRSV-[IN:Kar:Bgk:Pap:21]. Among 32 begomoviral samples 13 representative isolates were subjected for RCA based characterization, out of which 4 were found new distinct species of begomovirus and based the ICTV species classification, proposed the name for the isolates as PaLCuBKV-[IN:Kar:Bel:Pap:21]; PaLCuBKV-[IN:Kar:Bgk:Pap:21] and PaLCuHV-[IN:Kar:Hav:Pap:21]. Another four were found as new strains and proposed the name as ChiLCV-[IN:Kar:Kal:Pap:21]; PaLCuV-[IN:Kar:Kal:Pap:21]; CYVMV-[IN:Kar:Kal:Pap:21] and PaLCuV-[IN:Kar:Vij:Pap:21]. Five isolates were demarcated as new variants and suggested the name as ChiLCV-

[IN:Kar:Bel:Pap:21]; ChiLCV-[IN:Kar:Bel:Pap:21]; ChiLCV-[IN:Kar:Bkg:Pap:21]; ChiLCV-[IN:Kar:Bkg:Pap:21] and ChiLCV-[IN:Kar:Kal:Pap:21].

Studies on the different months of planting under field conditions revealed that planting during March is effective for the management of PRSV as it recorded the least disease incidence (5.56 % at 60 DAT and took 270 DAT to reach 100 %) and maximum yield (185.54 t/ha) along with good growth and yield parameters. The effect of inoculation of PRSV at different growth stages of papaya revealed that percent transmission and severity of symptoms on PRSV inoculated papaya plants were drastically greater in early inoculated plants than in plants inoculated at later stages. As the inoculation was delayed there was reduction in diseases incidence and an increase in growth and yield parameters.

The studies on the management of PRSV under field conditions for two seasons (2019-20 and 2020-21) using insecticides and bio rationales revealed that T1 (8 sprays of four different insecticide i.e tolfenpyrad 15% EC @1 ml/l, imidacloprid 17.8% SL @ 0.2 ml/l, thiacloprid 21.7 SC @ 1 ml/l and dinotefuran 20 % SG @ 0.5g/l alternatively and micronutrients at every 30 days intervals) proved as the best treatment. It recorded the least diseases incidence (1.49 % at 210 DAT and took 360 DAT to reach 100%) and maximum yield (178.56 t/ha) along with a high cost-benefit ratio (1: 3.54). Looking into these results, three integrated diseases management modules were designed and evaluated along with recommended POP as a check and found that M1 (12 sprays insecticides i.e tolfenpyrad 15% EC @1 ml/l, imidacloprid 17.8%SL @ 0.2 ml/l, thiacloprid 21.7 SC @ 1 ml/l and dinotefuran 20 % SG @ 0.5g/l alternatively 3 times and micronutrients at 20 days interval) is the best module for managing PRSV (0.44 % incidence at 180 DAT and took 330 DAT to reach 100%).

Conclusions

Survey and characterization of begomoviruses associated with papaya leaf curl disease performed here provided a picture of papaya associated begomoviruses diversity in the major papaya production region of Karnataka, India. Survey, symptomatology, characterization and their phylogenetic relationship indicates leaf curl disease in papaya is associated with array of existing (ChiLCV, PaLCuV and CYVMV) and novel (PaLCuBKV and PaLCuHV) begomoviruses in major papaya growing areas of Karnataka, India. Documentation of different viruses and their strains of viruses present in a particular area provide important information for strategies to contain the leaf curl disease of papaya.

Further, our results indicated that PRSD was severely infected in almost all papaya plants irrespective of the age in major papaya growing region of Karnataka, India. Additionally, the PRSV characterized in the present study is closely related PRSV-HYD isolate (KP743981) from Hyderabad, Telangana, India. This is the first complete genomic characterization of PRSV from Karnataka (Southern India).

Further, influence of the month of planting and the susceptibility stage of papaya for PRSV infection was found that planting papaya in the month of March is a non-chemical, eco-friendly, and effective management strategy against the PRSV under field conditions. The severity and frequency of foliar symptoms on PRSV-infected papaya plants were found to be much greater in papaya plants infected at the early growth stage compared to those infected at a later growth stage. As a result, the early crop growth stage (up to 180 DAT) is a critical period for PRSV infection, and effective disease management measures should be taken up to 180 DAT in order to manage the disease and achieve higher growth and yield attributes. Furthermore, the viral titer of PRSV was found to be positively correlated with symptom severity and percent transmission, with higher viral titers recorded in plants inoculated at an early crop growth stage, severe symptoms and high percent transmission rates than in later stages of crop growth.

The developed IDM strategy for two seasons proved that 8 sprays of four different insecticides *i.e* tolfenpyrad 15 % EC at 1 ml/l, imidacloprid 17.8 % SL at 0.2 ml/l, thiacloprid 21.7 SC at 1 ml/l and dinotefuran 20 % SG at 0.5g/l alternatively and micronutrients at every

30 days interval is found to be most effective against PRSV, with no incidence of disease at early crop growth stages (up to 180 DAT) which is a critical period for PRSV infection, along with maximum yield and high cost benefit ratio (1:3.54). Hence, it can be considered the best approach for efficiently arresting PRSD under field conditions. Furthermore, module (M₁) which contains 12 sprays of insecticides *i.e.* tolfenpyrad 15 % EC at 1 ml/l, imidacloprid 17.8 % SL at 0.2 ml/l, thiacloprid 21.7 SC at 1 ml/l and dinotefuran 20 % SG at 0.5g/l alternatively 3 times and micronutrients at 20 days interval is established as the best IDM module for managing the PRSD.

Keywords: PRSV, PaLCuV, Epidemiology, IDM, Insecticides and Biorationals

Management of Plant Genetic Resources and Varieties of Seed Spices Crops

R.S. Meena* and S.K. Bagra

ICAR-National Research Centre on Seed Spices

Purpose

India is known to have status of largest producer of seed spices crops. The seed spices crops have well domestication to India after their introduction from Mediterranean and Central Asian region, perhaps a long time ago. Presently the important seed spices grown in the country are coriander, cumin, fennel, fenugreek, ajwain, dill, nigella, celery, anise and caraway. The seed spices are well distributed over different agro-climatic regions in India. But the major belt spread from semi-arid to arid region covering large area in Rajasthan and Gujarat. Besides other growing states are M.P. Bihar, U.P, West Bengal, Orissa, Tamil Nadu, Punjab and Karnataka. The level of productivity in various seed spices is comparatively low as compared to other countries. There are many production constraints attributed to low productivity. The lack of suitable high yielding varieties suiting to different agro-ecological regions and more incidences of diseases and insect pests are the major reasons for low productivity in the country. However, the non-availability of quality seed lack of information on post harvest handling, storage and processing for value addition and few others are also considered as threats to successful production of quality seed spices for domestic and export market.

Spices denote all the aromatic or pungent substances of vegetable origin which are commonly used to seasoning food dishes and to make them tasteful. India has been known as the home of spices and also the world's largest producer, consumer and exporter of seed spices, which are being cultivated widely in the country over different agro-climatic zones. About 63 plant species, which yield spices, are cultivated in the country. The important among them, which occupy a sizeable area and enter the National and/or International trade are black pepper, cardamom, ginger, turmeric, chilies, clove and seed spices.

The Seed spices are those annuals whose dried fruits or seeds are used as condiments. Seed spices are grown in low rainfall areas and fewer inputs are given as compared to other crops. These crops are extensively grown in semi arid and arid regions of India during rabi season. Out of the total 20 seed spices grown in the country, nine are prominent as they are cultivated on sizeable area and contribute to the economy.

Germplasm Holdings

The systematic germplasm resource activity with long term objectives started only in 1975 with the establishment of a centre of All India Coordinated Spices Improvement Projects (Now AICRP on Spices) in the country and after that establishment of NRCSS, Tabiji-Ajmer in 1997. The germplasm of seed spices have been evaluated for yield, adaptability and the reaction to diseases and pests, Maintained scientifically and updated with new accessions. The enhancement of genetic resources of seed spices crops have been continuous through different explorations being conducted within the country. Besides this efforts have also been made to collect germplasm from exotic sources. The total number of accessions maintained is as under:

Table 1 : Prominent seed spices grown in India and their origin

Name	Botanical Name	Family	Centre of origin
Major seed spices			
Coriander	<i>Coriandrum sativum</i> L.	Apiaceae	Mediterranean region
Cumin	<i>Cuminum cyminum</i> L.	-do-	-do-
Fennel	<i>Foeniculum vulgare</i> Mill.	-do-	South Europe and Mediterranean region
Fenugreek	<i>Trigonella foenum-graecum</i> L.	Fabaceae	South East Europe and West Asia
Minor seed spices			
Ajowain	<i>Trachyspermum ammi</i> Sprague	Apiaceae	Egypt & India
Dill (Sowa)	<i>Anethum graveolens</i> L. <i>Anethum sowa</i> Kurz	-do-	Europe, Africa & Asia
Celery	<i>Apium graveolens</i> L.	-do-	Mediterranean region
Aniseed	<i>Pimpinella anisum</i> L.	-do-	Eastern Mediterranean region
Nigella	<i>Nigella sativa</i> L.	Ranunculaceae	-do-
Caraway	<i>Carum carvi</i> L.	Apiaceae	Mediterranean region

Table 2: Germplasm assemblage of Seed Spices at ICAR-NRC on Seed Spices

Crop	NRCSS Collection			AICRPs	NAGS Holding
	Indigenous	Exotic	Present available		
Cumin	100	7	107	140	247
Coriander	169	3	172	373	545
Fenugreek	82	59	141	598	739
Fennel	118	3	121	251	372
Ajwain	99	1	100	9	109
Dill	106	5	111	3	114
Nigella	21	3	24	0	24
Celery	36	-	36	0	36
Anise	18	-	18	0	18
Caraway	8	2	10	8	18
Total	757	83	840	1382	2393

The indigenous germplasm collection has been made mainly through conducting “Survey and collection” tours during the cropping season. Exchange of germplasm between centers of the project has also contributed towards the collection. The exotic material has been obtained only through the efforts of the National Bureau of Plant Genetic Resources- New Delhi.

Germplasm Maintenance

Except fenugreek, which is self pollinated (and hence maintenance of germplasm is easy), others are cross pollinated to varying degrees. In these crops, each accession is generally grown every third year in rows. To check cross pollination. One meter uniform section of each row is covered with muslin cloth cage before the initiation of anthesis. The seed produced in cage are saved as representative of the accession. The system, however, suffers from the weaknesses like smaller number of the plants sampled and increase of self-pollination under the cages. Methods to obviate these weaknesses are in situ preservation, synthesis of broad base gene pools/gene reservoirs, long term storage and in *vitro* preservation etc.

Table 3: Varieties of seed spices at ICAR-NRC on Seed Spices, Ajmer

S. No.	Name of the crop	Name of the variety	Characteristics
1	Coriander	Ajmer Coriander - 1	Seed yield 10-12q/ha. Seeds contain essential oil up to 0.4% Plants are resistant to stem gall. It is cultivated in Rabi season.
		Ajmer Coriander - 2	Seed yield 12-13 q/ha. Seeds contain essential oil up to 0.5-0.6%. Plants are resistant to stem gall and tolerance to powdery mildew. It is cultivated in Rabi season.
		Ajmer Coriander - 3	Seed yield 16-17q/ha. Seeds contain essential oil up to 0.52-0.56%. Moderately resistant to powdery mildew. Mature 120-130 days. It is cultivated in Rabi season.
		Ajmer Green Coriander -1	Leaf yield 74.32q/ha. It matures 50-60 days. Leaf contains essential oil 0.05 %. Seeds contain essential oil up to 0.36%. Moderately resistant to powdery mildew. It is cultivated in Rabi season.
2	Fenugreek	Ajmer Fenugreek - 3	Seed yield 13-14 q/ha. Moderately resistant to powdery mildew and root rot. Its seeds contain 1.79 % diosgenin and 0.97 % 4-hydroxyisoleucine. It is cultivated in Rabi season.
		Ajmer Fenugreek - 4	Seed yield 19.5 q/ha. Moderately resistant to powdery mildew and root rot. Its seeds contain 1.74 % diosgenin and 0.94 % 4-hydroxyisoleucine. It is cultivated in Rabi season.
		Ajmer Fenugreek - 5	Seed yield 17-18q/ha. Moderately resistant to powdery mildew and <i>Alternaria</i> blight. Seeds of AFG-5 showed higher antioxidant properties (66.4mg BHTg ⁻¹ seeds). It is cultivated in Rabi season.
3.	Fennel	Ajmer Fennel -2	Seed yield 17-18 q/ha. This variety has tolerance to <i>Ramularia</i> and <i>Alternaria</i> blight.

			The seeds contain 1.9% essential oil and 57.5% anethole & estragol combined. It is cultivated in Rabi season.
		Ajmer Fennel -3	Seed yield 21.43 q/ha. This variety has moderately resistant to <i>Ramularia</i> blight. The seeds contain 1.9% essential oil and 45% anethole & estragol combined. It is cultivated in Rabi season.
4.	Ajwain	Ajmer Ajwain -93	Seed yield 10-12 q/ha. The seeds yield essential oil content of 3.0%. It is early maturity variety (30-40 days early). It is cultivated in Rabi & Kharif season.
		Ajmer Ajwain -73	Seed yield 10.66.q/ha. The seeds yield essential oil content of 6.38%. It shows high tolerance to Root rot and <i>Sclerotium</i> rot. It is cultivated in Rabi & Kharif season.
5.	Dill	Ajmer Dill-2	Seed yield is 14.6q/ha under irrigated and 5.8q/ ha under rainfed conditions. The seed contain about 3.2% essential oil. It is cultivated in Rabi season.
6.	Nigella	Ajmer Nigella -1	Seed yield: 8 -12q/ ha. The seeds contain about 0.7% essential oil. It is cultivated in Rabi season.
		Ajmer Nigella -20	Seed yield : 10-12 q/ ha The seeds contain about 0.7 % essential oil. It is cultivated in Rabi season.
7.	Celery	Ajmer Celery- 2	Seed yield 9.7q/ha. The variety having essential oil content of 3.8% from seeds. It is cultivated in Rabi season.

Future perspective to enhance use of genetic resources in crop improvement

Seed spices are still considered as under-utilized crops and serious attention has not been paid regarding systematic germplasm collection, evaluation and conservation. The prevailing diversity of these crops in remote and tribal pockets needs to be visited for exploration. There is tremendous scope for collection of valuable land races of seed spices crops. Most of the varieties developed so far have been developed through selection. To solve the specific problems of biotic and abiotic stress resistance, molecular techniques should be used non conventional breeding approaches. Therefore, all the germplasm should be molecularly characterized and this should be associated with specific characters. There should be free exchange of germplasm among the breeders involved in the improvement programme. Conservation of seed spices germplasm in the National Gene Bank especially with reference to National Active Germplasm Site is situated at Ajmer and NBPGR New Delhi. This material can explore for future breeding programme.

Green synthesis of silver nanoparticles from callus extract of *Salix tetrasperma*, its anti-microbial efficacy and monitoring of molecular docking analysis**Zubair Altaf Reshi¹, Saad Bin Javed^{1*}**¹*Plant Biotechnology Laboratory, Department of Botany, Aligarh Muslim University, Aligarh, 202002, India***Purpose**

Nanotechnology is a multidisciplinary field engaged in resolving issues related to food processing, pharmacology, and biological sciences. The most fundamental element for the construction of nanostructure is the development of a nanoparticle. These are nanometer-sized substances exhibiting remarkable and innovative properties. Green synthesis describes the production of nanoparticles (NPs) using biological samples. The study was aimed to develop silver nanoparticles (Ag-NPs) from callus extract of *Salix tetrasperma*. The biosynthesized Ag-NPs were evaluated for potential antimicrobial activities.

Method

The formation of Ag-NPs was primarily detected from the color change of the reaction mixture and subsequently verified by UV-vis spectroscopy, XRD and FTIR. Particle shape and average particle size was characterized by Scanning Electron Microscopy (SEM) and Transmission Electron Microscopy (TEM). Nematicidal, Antifungal and Anti-bacterial properties were studied against *Meloidogyne incognita*, *Macrophomina phaseolina* and *Pseudomonas aeruginosa* PAO1 respectively.

Result

The study demonstrated enhanced anti-microbial potential of green synthesized Ag-NPs. Maximum inhibition of hatching (65.54%) was recorded at 100 mgL⁻¹ Ag-NP concentration after 120 hours of inoculation of nematode eggs. Whereas maximum percentage (47.32%) of second stage juvenile nematode (J₂) mortality was recorded at similar concentration and time. The optimal concentration of 100 mgL⁻¹ Ag-NPs exhibited highest percentage (66.82%) of anti-fungal activity against *M. phaseolina*. A significant reduction in biofilm development was obtained by Ag-NPs at concentrations of 10 µg /ml (MIC/2) and 5 µg /ml (MIC/4). The molecular docking results revealed binding of biosynthesized Ag-NPs to LasI (IRO5) as well as LasR (2UVO) bacterial receptor proteins *P. aeruginosa* PAO1.

Conclusion

The present study validates the successful biosynthesis of Silver nanoparticles using callus extract of *Salix tetrasperma*. The investigation also observed the potential anti-microbial activities. We therefore consider the current effort to be a significant contribution to the scientific community in the advancement of nanomedicine through the use of environmentally friendly, sustainable and rapid production of metal nanoparticles.

Keywords: *Salix tetrasperma*, Callus, Green synthesis, Anti-microbial activity, Molecular docking.

A study on women empowerment level in agriculture for districts of Odisha**¹Rupashree Senapati, ^{1a}Siddharth Dev Mukhopadhyay***Department of Agricultural Extension, Palli Siksha Bhavan, Visva Bharati University, Bolpur, West Bengal***Purpose:**

In India, despite a considerable progress in the policy and legislative levels, women remain significantly less politically, economically and socially empowered than men especially in agriculture sector. . Most of the work that women do, such as working in the crop field for various activities, collecting fuel, fodder and water, growing vegetables and keeping poultry for domestic consumption go unrecorded in the census of the country. For an equitable and sustainable growth of agriculture. that we need to focus on qualitative research on the

contribution, role, empowerment and vulnerability aspects of farm women is the need of the hour. In this study, the objective was set to assess the empowerment level of women in agriculture in Odisha.

Method:

Keeping in view of this scenario a study was conducted to ascertain the extent of empowerment of farm women in Odisha regarding their cosmopolitanness, access to information, media exposure, decision making power, ownership of resources, impact regarding climate change etc. Three districts of Odisha (Puri, Gajapati and Devagarh) were selected representing the three administrative zones (Northern, Southern and Central zone) with 100 respondents from each district. Using the random sampling and a structured schedule method, data was collected in 2021 and 2022. Mean, Standard deviation, Indexing, correlation and regression method of statistical analysis were applied for des

Result:

After suitable analysis an overall empowerment index was developed for all the three districts. The study suggested that the empowerment level is less than 50% for farm women with respect to the selected variable under study. The empowerment level for individual districts was also calculated, which depicted again less than 50% empowerment level amongst farmwomen.

Conclusion

This is definitely an alarming situation and needs more attention regarding research, development and policy making.

Keywords:

Empowerment, women in agriculture, farm women, contribution, role, cosmopolitanness

Antagonistic potential and growth promoting activity of chickpea rhizospheric fungi against *Rhizoctonia bataticola* causing dry root rot in chickpea

Meghana S Patil and Gururaj Sunkad

University of Agricultural Sciences, Raichur-584 104, Karnataka, India

Purpose

The recent rise in global temperature and worsening of drought spells has aggravated dry root rot outbreaks in chickpea. However, for the sustainable management of the disease, the knowledge on the interactions between PGPMs and pathogens under hostile environmental conditions is still rather limited. Hence, there is a need to explore plant growth promoting microorganism (PGPMs) now for the purpose of improving plant growth and as well as management of chickpea dry root rot.

Methods

Twenty six fungal PGPMs were isolated from the chickpea rhizosphere using serial dilution technique and their antagonistic potential was tested by dual culture technique. Further to know their plant growth promoting activity, standard procedures of IAA, Siderophore, HCN, Ammonium production and Phosphate solubilization were followed.

Results

From dual culture technique, three rhizospheric fungi among 26 PGPMs (SFPGPM-3, SFPGPM-9, SFPGPM-13) with more than 70 per cent mycelial inhibition were identified as potential in suppressing pathogen under *in vitro*. All the three were positive for IAA, Siderophore, HCN, Ammonium production and Phosphate solubilization.

Conclusions

The fungal isolates isolated from the healthy chickpea rhizosphere have ability to hinder the growth of *Rhizoctonia bataticola* and also capable of promoting the chickpea growth.

Keywords: Antagonistic potential, Chickpea, Dry root rot, *Rhizoctonia bataticola*

Effect of boron on morpho-physiological characters of Darjeeling mandarin seedlings under aluminum stress condition**Novin Chamling and Nilesh Bhowmick***Pomology and Post-harvest Technology, UBKV, Pundibari, Cooch behar-736165***Purpose**

Darjeeling mandarin orange is one the finest orange in India. It is mainly grown in Darjeeling and Sikkim. However, at present the declination is at peak and some of the factors include such as aluminium (Al) toxicity. It is the mostly threat soil constraint for plant growth and development in acid soils (pH < 5.5). Boron (B) is an essential micronutrient for the growth and development of higher plants. None of the studies have been conducted on mandarin orange to study the effect of boron on alleviating aluminium toxicity.

Methods

An experiment was conducted in mandarin seedlings grown in pot culture with Hoagland solution comprising of two different levels of aluminium concentration (0 μ M and 1200 μ M) and four levels of boron (0 μ M, 5 μ M, 10 μ M and 25 μ M). Boron treatments were applied for every aluminium concentration to investigate the ameliorative role of boron under aluminium toxicity and exploring the underneath mechanisms.

Results

The result showed that aluminium toxicity hinders the growth and development of plants and also severely hamper on the root traits. However, application of boron under the presence of aluminium toxicity improved morpho-physiological characters and root traits of seedlings. Among the boron levels, boron (10 μ M) were found to have significant effect in seedlings thereby alleviating aluminium toxicity in mandarin seedlings.

Conclusion

The present study showed that application of boron improved the root growth and physiological characteristics of plants under aluminium toxicity. Activation of antioxidant enzymes systems and the reduction of oxidative damage and root injury by adequate application of boron resulted in alleviation of aluminium toxicity. The results highlight the beneficial role of boron in response to toxic effects of aluminium in mandarin orange.

S=

Effect of mulberry leaf dipping in various nutritional ingredients on life cycle of silkworm Waykule PK *, Dane A.V., More D.G.*Department of Agriculture Entomology, College of Agriculture, Parbhani**Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani- 431 402 (M.S), India.***Purpose:**

Indian sericulture market in 2017 was worth INR 205 billion. The market further projected to reach INR 553 billion by 2023. India is producing over 30,000 tonnes raw silk every year which is about 18% of the world. India is currently second largest producer of raw silk as well as largest consumer of raw silk and silk fabrics. The market for silk in India is driven by both exports and very strong domestic demand. Annual export of silk and silk products is US\$ 400 million. Considering all this the present study was undertaken to know impact of various nutritional additives on biology and economic traits of bivoltine mulberry silkworm *B. mori* (L.)

Method:

Effect of N, P, K, micronutrients (Mg & Zn) & Vit. B on life cycle and economic traits of bivoltine silkworm (*B. Mori* L.) was studied. One hundred silkworm larvae were reared in each replication. The 7 treatments were included in the experiment as first Mulberry leaves dipped in 0.2% N + 0.1% P + 0.3% K + 0.15% Mg, Second Mulberry leaves dipped in 0.2% N + 0.1% P + 0.3% K + 0.02% Zn, third Mulberry leaves dipped in 0.2% N + 0.1% P + 0.3% K + 0.1% Folic acid (Vit. B), Fourth

Mulberry leaves dipped in 0.2% N+ 0.1% P+ 0.3% K + 0.15% Mg+ 0.02% Zn, Fifth Mulberry leaves dipped in 0.2% N + 0.1% P+ 0.3% K + 0.15 Mg+ 0.02% Zn +0.1% Folic acid (Vit. B),Sixth Mulberry leaves dipped in 0.2% N + 0.1% P + 0.3% K, Seventh Mulberry leaves dipped in water (control)

RESULT:

The study of optimum element doses i.e., 0.2%, 0.3%, 0.1%, 0.1%, 0.15% and 0.5% of various minerals i.e., N, P, K, Ca, Mg and Cu, respectively in various combinations on larval development and silk production of *B.mori* L shown various results. However, where mulberry leaves offered with 0.2%N + 0.3% K + 0.1% Ca + 0.1% P + 0.15% Mg+ 0.5% Cu concentration gave the best results. (Ashfaq *et .al* 2000).

CONCLUSION:

The study revealed that feeding mulberry leaves dipped in solution containing 0.2 % N + 0.1 % P + 0.3 % K + 0.1 % folic acid (Vit. C) recorded shortest larval period, however mulberry leaves dipped in solution containing 0.2% N + 0.1% P + 0.3% K+ 0.15 % Mg + 0.02 % Zn resulted in highest moth emergence, maximum fecundity and hatching percentage of mulberry silkworm

Keywords: Mulberry, Nitrition, *Bombyx mori*, Silkworm

Dwindling floristic composition and diversity of alpine medicinal plants due to climate change in Paddar Valley of North West Himalayas

Anil Thakar¹ Deeksha Dave²

School of Interdisciplinary and Transdisciplinary Studies, Indira Gandhi National Open University, New Delhi-110068

Purpose:

The purpose of this study is to evaluate the ecological condition, ethnobotanical usage, and sustainability of high-altitude medicinal plants in the Paddar Valley of Kishtwar district, Jammu and Kashmir, as well as to identify the priority species that are threatened due to climate change and rapid degradation of the Himalayan ecosystem.

Method:

Ground truthing floristic survey was conducted to ascertain the ecological status and species distribution to determine the range of plant density in the area. A total number of 16 species were priorities based on the Rapid Threat Assessment exercise, stratified random sampling and the perception of locals regarding the ecological status of these species. The researchers determined the richness of medicinal plants in the area and how the type of vegetation, altitude, and slope influenced the types and number of species present in an area, as well as their distribution. The diversity and evenness of species was determined as gradient in elevation changes.

Results:

The study found that the Paddar Valley of Kishtwar district, Jammu and Kashmir, is an important area for high-altitude medicinal plants, with a wide range of plant density (0.07 - 15.3) plant m⁻². The researchers identified 16 priority species that are threatened due to rapid degradation of the Himalayan ecosystem, with *Saussurea atkinsonii*, *Arnebia Benthamii*, *Aconitum heterophyllum*, *Dactylorhiza hatageria*, and *Picrorhiza kurroa* being the most threatened. The study also found that the Asteraceae family had the highest richness of medicinal plants, while Apiaceae and Violaceae recorded lower plant richness. The type of vegetation, altitude, and slope influenced the types and number of species present in an area, as well as their distribution. The diversity and evenness of species increased gradually as elevation increased, with the highest values occurring at mid-elevations (Ecotone subalpine-alpine). Site-II had the greatest species richness, while Site-V exhibited a deficit of species due to increase in temperature at higher altitude as climate change factor and exploitation by locals

and the nomadic community. These findings emphasize the need for effective monitoring and conservation measures for sub-alpine and alpine pastures.

Conclusion:

The results of the study indicate that there is a positive relationship between species richness and elevation, which reaches a maximum at intermediate elevations, resulting in a "diversity bulge" pattern. This finding is consistent with the established ecological theory that suggests that intermediate disturbance levels promote greater species diversity. Therefore, there is need for effective monitoring and conservation measures for sub-alpine and alpine pastures in the Paddar Valley of Kishtwar district.

Keywords: Alpine, Biome, Richness, Climate change, Rapid Threat Assessment, Ethnobotany

Activity of Glutathione S-transferase enzyme in field evolved resistance of *Empoasca flavescens* Fabricius on tea.

Biswajit Patra

Regional Research Station (Hill Zone), Uttar Banga Krishi Viswavidyalaya, Kalimpong, West Bengal-734301, India.

Purpose

Tea green fly or tea jassid, *Empoasca flavescens* Fabricius is one of the most important sucking pests of tea. Of late this pest has become a serious concern in Sub-Himalayan tea plantations of West Bengal, India. In spite of routine application of insecticides there were some incidences of management failure of this pest (Saha *et al.* 2012). Considering the importance of the problem to the tea industry, the present experiments were conducted with the objectives to study the insecticide susceptibility status of *E. flavescens* and to study the role of Glutathione S-transferase activity.

Methods

Three commonly used neonicotinoids and three synthetic pyrethroids *i.e.*, total six insecticides were tested against five populations of *E. flavescens*. Bioassay experiments were conducted with the field collected populations and Glutathione S-transferase activities were estimated.

Results

Resistance to the tested insecticides was very low. It seems that resistance development against the tested insecticides was in initial stage. Thiamethoxam was found to be the least toxic insecticide and clothianidin was the most toxic insecticide. Higher activity of GST was found to be associated with the reduced susceptibility against the tested insecticides.

Conclusion

As very low level of resistance against the tested insecticides was detected, use of these insecticides may be continued for management of tea greenfly but chemicals having similar mode of action should not be used repeatedly. Clothianidin and deltamethrin were found to be the two promising molecules against tea greenfly.

Keywords: *Empoasca faveszens*, Glutathione S-transferase, Neonicotinoids, Susceptibility, Synthetic pyrethroids, Insecticide resistance.

Reference:

Saha D, Roy S, Mukhopadhyay A (2012) Seasonal incidence and enzyme-based susceptibility to synthetic insecticides in two upcoming sucking insect pests of tea. *Phytoparasitica* 40:105–115. <https://doi.org/10.1007/s12600-011-0203-3>

Transforming Waste into Resource: Synthesis and Characterization of Rice Husk Nanobiochar-Based N and K Fertilizers for Sustainable Groundnut (*Arachis hypogaea* L.) Production

K. Nagaraju¹, T.N.V.K.V. Prasad², M.V.S. Naidu¹, M. Sreenivasa Chari³, Y. Reddi Ramu⁴,

B. Ramana Murthy⁵, K.V. Naga Madhuri², T. Giridhara Krishna² and A.G. Damu⁶

*1*Department of Soil Science and Agril. Chemistry, S.V. Agricultural College, ANGRAU, Tirupati-517502, A.P. India

*2*Department of Soil Science, IFT, RARS, ANGRAU, Tirupati-517502, A.P. India

*3*Department of Soil Science and Agril. Chemistry, Agricultural Research Station, ANGRAU, Utukur-516003, Kadapa, A.P. India

*4*Department of Agronomy, S.V. Agricultural College, ANGRAU, Tirupati-517502, A.P. India

*5*Department of Statistics and Computer Applications, S.V. Agricultural College, ANGRAU, Tirupati-517502, A.P. India

*6*Department of Chemistry, Yogi Vemana University, Kadapa-516005, A.P. India

Purpose

This study examined the physical and chemical properties of nitrogen and potassium fertilizers based on rice husk nanobiochar and evaluated their effectiveness as fertilizers. The fertilizers were made by combining rice husk nanobiochar, ammonium sulphate and potassium sulphate.

Methods

The physical and chemical properties of the fertilizers were thoroughly analyzed using various techniques, including ultimate and proximate analysis, total elemental analysis, Dynamic Light Scattering (DLS), Fourier Transform Infrared Spectroscopy (FTIR), X-ray Diffractometry (XRD), Scanning Electron Microscopy (SEM) and Energy-Dispersive X-ray Spectroscopy (EDX). A pot experiment was conducted to investigate the effects of the fertilizers on the growth and yield of groundnut.

Results

The results showed that the nitrogen and potassium fertilizers based on rice husk nanobiochar contained over 50% total carbon and had a porous structure. The mixing of rice husk nanobiochar, ammonium sulphate, and potassium sulphate in the adsorption process was dominated by physical adsorption. The pH of the nitrogen-based fertilizer made from rice husk nanobiochar was neutral, while the pH of the potassium-based fertilizer made from rice husk nanobiochar was slightly alkaline, but the pH of the fertilizers loaded with rice husk nanobiochar decreased. When applied to sandy clay loam soil, the nitrogen and potassium fertilizers based on rice husk nanobiochar significantly improved the growth and yield of groundnut, enhanced the efficiency of nitrogen and potassium use and reduced nutrient losses from leaching and other factors.

Conclusions

The study concludes that combining rice husk nanobiochar with fertilizers can not only promote crop growth and increase yield but also improve the agricultural use of biochar.

Keywords: Rice husk biochar, rice husk nanobiochar, rice husk nanobiochar based nitrogen fertilizer, rice husk biochar nanobiochar based potassium fertilizer, nutrient efficiency, reduce leaching losses, increase yield.

***In Vitro* Evaluation Of Phytoextract Against *Alternaria solani* Caused Early Blight Of Tomato**

Patil M. G.¹, Bhalerao P. Ambadkar C.V.³

Department of Plant Pathology, College of Agriculture,

Vasntarao Nail Marathwada Krishi Vidyapeeth, Parbhani, (M.S.) 431402, India

Purpose

Tomato (*Lycopersicon esculentum* Mill.) belongs to family solanaceae is an important fruit vegetable and ranks next to potato in world acreage and is first amongst processing crops. Tomato production worldwide is usually restrained by various infections, among them mainly the early blight caused by *Alternaria solani*. Lately, there has been a growing concern over the use of synthetic fungicides on environmental and food safety, hence the need to explore other alternatives that are friendly to the user, the consumer, and the general environment. This research sought to test the potency of phytoextracts against *A. solani*. Results obtained on *in vitro* evaluation of various phytoextract at 10 and 20 per cent concentration revealed that highest mycelial growth inhibition of the test pathogen was recorded with *Azadiracta indica* 73.03% and 75.36% whereas, *Parthenium hysterophorus* 73.03% and 61.96% respectively which was found comparatively less effective as compared to untreated control.

Methodology:

Efficacy of botanicals (plant extracts) against *Alternaria solani* were tested by using poisoned food technique under *in vitro* conditions (Nene and Thapliyal, 1993). Fresh healthy plant parts of 100 g (leaves), were collected from field, washed with tap water and air dried. Then crushed separately in 100 ml. of distilled water (w/v). Macerates obtained were filtered separately through double layered muslin cloth in 100 ml. volumetric flask (100 ml cap.). Potato dextrose agar medium was used as nutrient medium and required quantity of each plant extract was added separately to get a required concentration of the plant extract. The plant extract was thoroughly mixed with PDA medium and sterilized at 121 °C for 20 minutes. Twenty milliliters of poisoned medium were poured to each of the 90 mm petri dishes and allowed for solidification. Simultaneously without plant extract PDA was poured in petri dishes as control. Actively growing 7-day old culture of *A. solani* was carefully cut using a cork borer and transferred aseptically at the center of each petri dish containing the poisoned/non-poison solid medium. The plates were incubated at 26 ± 2 °C. Each treatment was replicated four times. The per cent growth inhibition of the fungus in each treatment in comparison with control was calculated by the equation (Vincent, 1927). Observations on radial mycelia growth was recorded in all the replicated treatments at 24 hours interval and was continued till the control (untreated) plate is fully covered with mycelia growth of the test pathogen. Percent inhibition of the growth of the test pathogen was calculated by applying the formula given by Vincent (1927).

$$\text{Per cent inhibition} = \frac{C - T}{C} \times 100$$

Where C = Growth (mm) of test fungus in untreated control plate

T = Growth (mm) of test fungus in treated plates

Results:

Radial mycelial growth

At 10 and 20 per cent leaf extract least mycelial growth was recorded with the *Azadiracta indica* (24.23mm and 22.16 mm) which was significantly superior over all treatments followed by *Ocimum sanctum* (26 mm and 24.33mm), *Eucalyptus globulas* (30 mm and 26 mm), *Datura stramonium* (33.16 mm and 30.83 mm), *Lantana camara* (34.5 mm and 30 mm), *Brassica junicea* (39.06 mm and 29 mm). *Annona squamosa* (39.66 mm and 32.5 mm), *Parthenium hysterophorus* (44.16 mm and 34.23mm) respectively.

Mycelial growth inhibition:

At 10 per cent and 20 per cent significantly highest mycelial growth inhibition was recorded with *Azadiracta indica* (73.07% and 75 %) which was significantly superior over all treatments and was followed by *Ocimum sanctum* (66.66% and 72.95%), *Eucalyptus globulas* (66.66% and 71.11%), *Datura stramonium* (63.14% and 65.73%), *Lantana camara* (61.66% and

66.66%), *Brassica juncea* (56.66% and 67.77%). *Annona squamosa* (55.84% and 63.88%) and *Parthenium hysterophorus* (50.84% and 61.96%) respectively.

Table 1: *In vitro* evaluation of phyto extracts against *A. solani*

Tr. No.	Treatment	Colony Dia *(mm)#		Avrg.dia. (mm)	% Inhibition #	
		10%	20%		10%	20%
T ₁	<i>Brassica juncea</i>	39.06 (38.68)	29 (32.58)	34.03	56.66 (48.82)	67.77% (55.40)
T ₂	<i>Parthenium hysterophorus</i>	44.16 (41.64)	34.23 (35.80)	39.19	50.84 (45.48)	61.96 (51.91)
T ₃	<i>Datura stramonium</i>	33.16 (35.15)	30.83 (33.72)	31.99	63.14 (52.61)	65.73 (54.16)
T ₄	<i>Eucalyptus globulus</i>	30 (33.21)	26 (30.65)	28	66.66 (54.73)	71.11 (57.48)
T ₅	<i>Annona sqamosa</i>	39.66 (39.03)	32.5 (34.75)	36.08	55.84 (48.35)	63.88 (53.05)
T ₆	<i>Lantana camara</i>	34.5 (35.97)	30 (33.21)	32.25	61.66 (51.74)	66.66 (54.73)
T ₇	<i>Azadirecta indica</i>	24.23 (29.48)	22.16 (28.08)	23.19	73.07 (58.73)	75.36 (60.23)
T ₈	<i>Ocimum sanctum</i>	26 (30.65)	24.33 (29.55)	25.16	66.66 (54.73)	72.95 (58.66)
T ₉	Control	90.00 (71.56)	90.00 (71.56)	90	-	-
SE(m) ±		0.738	0.884		0.813	0.982
C.D (P=0.01)		2.208	2.648		2.434	2.941

*Mean of three replications, Dia.=Diameter,

#Figures in parenthesis are arc sine transformed value

Conclusion:

Significantly least mycelial growth was recorded with the *Azadirecta indica* (23.19 mm) which was followed by *Ocimum sanctum* (25.16mm) and higher mycelial growth was observed in *Parthenium hysterophorus* (39.19mm). However, significantly least mean mycelial inhibition was recorded with the *Azadirecta indica* (74.21%) which was followed by *Ocimum sanctum* (69.80%) and lower mycelial inhibition was found in *Parthenium hysterophorus* (56.4%) were found comparatively less effective as compared to untreated control.

Results of the present study are in conformity with the reported earlier by several workers. Phytoextracts viz., mustard, parthenium, dhatura, eucalyptus, custard apple, Ghaneri, neem, tulsi were reported to be antifungal against *A. solani*, *A. brassicae/A. brassicola*, *A. Alternata*, and other *Alternaria* spp. by several workers (Sasode *et al.*, 2012; Waghe *et al.*, 2015 and Pun *et al.*, 2020).

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Response of Winter Dawn and Chandler strawberry (*Fragaria × ananassa* Duch.) cultivars against tolerance of salinity stress**Rahul R Rodge*¹, Rajni Rajan¹ and Ab Waheed Wani¹**¹*Department of Horticulture Lovely professional university, Phagwara Punjab – 144411***Purpose**

Strawberry (*Fragaria × ananassa* Duch.) is one of the most salt-sensitive horticultural crops, and important to the economies thus, the increasing salinity (electrical conductivity) of irrigation water in some areas of the world is a growing concern to strawberry growers due to climate change. Salinity can cause leaf burns, necrosis, nutritional imbalance, or specific ionic toxicity (due to sodium and chloride accumulation); this decreases the quality and yield of fruit, and increases the probability of plant mortality some of the cultivars of strawberry. In order to check the salt tolerance two varieties i.e Winter Dawn and Chandler were selected in present study.

Method

The experiment was conducted in agriculture farm at Lovely professional university during the year 2022-2023. Two varieties of strawberry (*Fragaria × ananassa*) Winter Dawn and Chandler were evaluated for salt tolerance in a polytunnel environment at different salt stress conditions. The salinity was imposed with NaCl at different concentrations and at vegetative phase. Plants were provided with the respective concentration of NaCl (0 mM, 50 mM, 75 mM, and 100 mM NaCl) after measuring the EC of the potting mixture. To compare the effect of salt stress a control set of the plant were maintained near to the each of the treatment, the control plants were treated with water without any added NaCl.

Result

From this study, the Chandler variety showed more tolerance as compared to winter dawn in terms of plant height (25 cm), leaf area (20.3 sq. cm), chlorophyll (52.1), fruit length and diameter (41.81 and 34.09mm), LRWC (89.3%), electrolyte leakage (0.50 %) and Leaf proline (22.57 $\mu\text{Mol g}^{-1}$), Membrane stability Index (89.2 %).

Conclusion

Hence, Chandler variety performed better in the saline area with respect to yield characters. So, it is better to cultivate such variety in high pH soils to boost the economy of farmers.

Keywords: Strawberry, salinity, chandler, winter dawn, crop**Ethical Foundations for Addressing Climate Change: Insights from Religious Texts and Ethical Upbringing****Abdulwasey Mohammed**

Seump Trus, Rajender Nagar, K.V. Ranga Reddy Dist.,

Purpose

Climate change is a pressing global challenge that requires comprehensive solutions, including ethical considerations. While scientific events and organizations focus on mitigation strategies and global policy adoption, the ethical aspect of climate change often goes overlooked. This may be due to the disconnect between science and religion in the Western world or the perception that modern scientific knowledge surpasses traditional ethical wisdom.

Methods

This paper argues that investigating the role of religious texts and ethical upbringing can provide a strong ethical foundation for addressing climate change challenges globally. Drawing on verses from the Quran and Hadiths of Prophet Muhammad, which promote sustainable living and discourage exploitation, the paper highlights how religious teachings can contribute to addressing climate change from an ethical perspective. For instance, the Quran links disasters directly with human actions, emphasizing the need for responsible stewardship of the

environment. Additionally, many Hadiths teach principles of sustainable living, emphasizing the importance of conservation and sustainability.

Results

The paper also explores the potential of adopting these ethical principles from religious texts as part of a UN Charter on climate change, which could benefit the entire planet. By incorporating ethical teachings from religious texts into global policy frameworks, it may be possible to create a shared ethical understanding that transcends religious and cultural differences and promotes responsible environmental behavior. This could contribute to more widespread adoption of climate change policies and sustainable practices at the individual, community, and global levels.

Conclusions

The findings of this paper contribute to the growing discourse on the ethical dimensions of climate change and highlight the need for interdisciplinary approaches that integrate scientific knowledge with traditional ethical wisdom. The paper also emphasizes the importance of considering cultural and religious perspectives in addressing climate change, and the potential of religious texts and ethical upbringing as a source of ethical guidance for sustainable living. The insights from this research can inform policymakers, scholars, and practitioners working on climate change mitigation and adaptation strategies, and promote a more holistic and inclusive approach to addressing this global challenge.

Keywords: *Climate Change, Impacts, Adoptions, Policies, Ethics, Islam, Quran, Hadith*

Response Of Foliar Nutrition On Growth And Yield Of Finger Millet (*Eleusine coracana* L. Gatern.)”

S. Karak¹ & U.Thapa²

Department of Agronomy, Faculty of Agriculture, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia-741252, West Bengal¹

Department of Vegetable Science, Faculty of Horticulture, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia-741252, West Bengal²

Purpose

Millets are small-seeded grasses that are hardy and grow well in dry zones as rain-fed crops under marginal conditions of soil fertility and moisture. Amongst the small millets, finger millet is the most climate resilient crop, which can be grown under a wide spectrum of extreme climatic conditions. Thus, they can be termed as “farmer friendly” crops providing them better returns in comparison to other crops, which are subjected to changing climatic conditions. Millet is possibly the best solution for “climate smart agriculture,” as it is easy to grow, much more versatile, and more climate-proof than rice or wheat. Millets are also known as ‘famine reserves’ due to their prolonged shelf life of more than two years without deterioration (Sahu and Sharma, 2013).

Among the various agronomic management practices, nutrient management has an important role in maximizing the biological yield, increase the uptake of macro nutrients and sustaining the post harvest soil nutrient status. Foliar application is the most effective method of application of water-soluble fertilizers. Foliar spray enables plants to absorb the applied nutrients from the solution through their leaf surface and thus, may result in the economic use of fertilizer. Foliar application of nutrients is feasible, economically viable and environmentally friendly approach of nutrient management. There is limited research on the foliar nutrition on growth and yield of finger millet. In light of this, not much work has been done in our country on this field and information is lacking. Taking this into account, the present investigation entitled ““Response of foliar nutrition on growth and yield of Finger millet (*Eleusine coracana* L. Gatern.)” was outlined with the following objectives:

To study the effect of foliar nutrition on growth and yield attribute of Finger millets.

Methodology

The present experiment entitled on “Response of foliar nutrition on growth and yield of Finger millet (*Eleusine coracana* L. Gaertn.)” was conducted during *kharif* season of 2022 at Farmers’ field, Arjipirchak Chandrakona, Paschim Medinipur.(22.68°N latitude , 87.55°E longitude) comes under Red lateritic and old alluvium agro climatic zones. Average annual rainfall is 1500-1600 mm, Air temperature (annual normal) Maximum-42.0°C in the month of May and of 11.0°C in the month of January.. The soil of the experimental field was sandy-loam in nature (containing 43.9% sand, 49.8% silt, and 6.3% clay), having pH of 5.5, available N 320 kg ha⁻¹ , P 31 kg ha⁻¹ and K 110 kg ha⁻¹. The experiment was laid out in Randomized Block Design replicated thrice consisting of 6 treatments [T₁: RDF + Panchagavya @ 3%, T₂: RDF + KNO₃ @ 2%, T₃: RDF + NPK (19:19:19 @ 2%) T₄: RDF + Zinc @ 0.5%, T₅: RDF + Boron @ 0.2%, T₆: RDF (N, P₂O₅ and K₂O: 30, 30, 30 kg ha⁻¹) only, respectively.

RESULTS

It reveal from the investigation that the growth and yield attributing characters viz, plant height(cm) number of tillers, number of fingers ,finger length and 1000grain weight (g) were influenced significantly by the different treatments with the application of foliar nutrition. Among the different foliar spray treatments significantly the highest plant height of 17.87.cm, 67cm a.14 cm and 100.65 cm , respectively was obtained during the different sampling period (30 DAS, 60 DAS and at Harvest) with treatments T₃ [RDF +NPK (19:19:19) @ 2%]. The highest plant height with the application of RDF +NPK (19:19:19) @ 2%] may be due to balanced and increased availability of nutrients to the crop due to fertilizer application. These results are in agreement with the findings by Ullasa *et al.*, (2016). The highest number of tillers per plant was also recorded from the plant which receive the foliar nutrition of N: P: K (19:19:19) @ 2% along with RDF at all sampling DAS with the values of 2.29, 3.52 and 5.33, respectively followed by the treatment (RDF+ Panchagova @ 3%) i.e. 1.87, 3.16 and 5.23 number of tillers at 30, 60 and at harvest , respectively. The highest number of tillers might be due to better nutrition of crop which helps to boost more number of tillers. The lowest number of tillers per plant of 1.48, 2.92, and 4.06 was recorded from the plant which received only RDF with water spray only.

The yield attributes like number of fingers ear⁻¹, finger length and 1000 grain weight were also in similar trends as growth characters. Foliar nutrition application influence significantly on number of fingers ear⁻¹ also. The significantly the highest number of fingers ear⁻¹(5.92), finger length (8.86) and 1000grain weight (6.23g)) was recorded with T₃ [RDF +NPK (19:19:19) @ 2%]. Harvest index was found significant due to different foliar nutrition. The effect of foliar nutrition on harvest index amongst the treatments was significant variations. The highest Harvest index of 44.31 % was observed in the T₁: RDF + Panchagavya @ 3%, which was significantly superior over rest of the other treatments.

The grain and straw yield of finger millet as influenced by different treatments are also found to be significant. Foliar spray of nutrition has resulted variable yield differences among the treatments. The highest grain yield 26.19q^{ha-1} and straw yield 34.70^{ha-1} were recorded by RDF +NPK (19:19:19) @ 2%]. Which was superior over foliar spray of RDF + KNO₃ @ 2%, , RDF + Zinc @ 0.5%, RDF + Boron @ 0.2%, T₆: RDF (N, P₂O₅ and K₂O: 30, 30, 30 kg ha⁻¹). The second highest grain and straw yield which was at par was obtained from T₁: RDF + Panchagavya @ 3% with the values of 25.12^{ha-1} and 31.56^{ha-1}, respectively.

The increased grain and straw yield with RDF + NPK (19:19:19 @ 2% could be due to the supplementation of balanced dose of nutrition as foliar spray which improved vegetative and yield attributing characters.

Conclusion

From the above investigation it was evident that the foliar application of nutrients on finger millets had a positive effect on the growth and yield of finger millets. In a conclusion

from the present findings it may be concluded that foliar application of N: P: K (19:19:19) @ 2% along with recommended dose of fertilizers (N, P₂O₅ and K₂O 30:30:30 kg ha⁻¹) found to be ideal for getting the higher productivity of grain and straw yield of finger millet.

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Chemosensitization Of Cisplatin Resistant ColonCancer By Lotus Derived Alkaloids Vijaya Padma*, PrasathManoharan

Translational Research Laboratory, Department of Biotechnology, Bharathiar University, Coimbatore -641 046, Tamil Nadu, India

Introduction

Chemotherapy to the colorectal cancer cells (CRCs) is accompanied by dose-limiting adverse effects along with the acquisition of drug resistance implicating low therapeutic outcomes. The present study is aimed to evaluate the chemosensitizing efficacy of neferine/isoliensinine or combinatorial regimen of neferine/isoliensinine with cisplatin against CSCs (cisplatin resistant colon stem cells).

Methods

CSCs were developed using pulse exposure of cisplatin to parental HCT-15 cells. The cytotoxic efficacy of Neferine /isoliensinine /combinatorial regimen of cisplatin + neferine /cisplatin + isoliensin were assessed and IC₅₀ dose were determined by MTT assay. After determining the IC₅₀ dose the cytotoxic efficacy of the neferine/ isoliensin /their combinatorial regimens with cisplatin was determined through ROS assay, intracellular calcium, mitochondrial membrane potential and their apoptosis inducing ability was determined through cell cycle analysis by flow cytometry and expression profile of pro and anti apoptotic proteins through western blotting.

Results

Neferine/isoliensinine or combinatorial regimens of Neferine/isoliensinine and cisplatin exhibited a stronger cytotoxic activity against CSCs compared to control. IC₅₀ doses were found to be 6.5 μM for neferine, 12.5 μM for isoliensinine, and 120 μM for cisplatin respectively. Furthermore, the combinatorial regimen of a low dose of cisplatin (40 μM) with 4 μM neferine/8 μM isoliensinine induced cell death in a synergistic manner as described by isobologram. Neferine/isoliensinine could confer extensive intracellular reactive oxygen species generation in CSCs. Neferine/isoliensin or combinatorial regimens dissipated mitochondrial membrane potential and enhanced intracellular [Ca²⁺]_i, which were measured by spectrofluorimetry. Furthermore, these combinatorial regimens induced a significant increase in the sub G₀

phase of cell cycle arrest and PI uptake and alleviated the expression of ERCC1 in CSCs. Combinatorial regimens or neferine/isoliensinine treatments downregulated the cell survival protein expression (PI3K/pAkt/mTOR) and activated mitochondria mediated apoptosis by upregulating Bax, cytochrome c, caspase-3, and PARP cleavage expression while downregulating the Bcl-2 expression in CSCs. CONCLUSION

Our study confirms the chemosensitizing efficacy of neferine/isoliensinine or combinatorial regimens of neferine/isoliensinine with a low dose of cisplatin against CSCs.

Keywords: Keywords: Neferine, isoliensinine, cisplatin, cancer stem cells (CSCs), apoptosis

Unraveling the Relationship Between Climate and Irregular Bearing of Red Delicious Apples in Jammu & Kashmir

Mansha Gul*, **B.K.Sinha***, **Gurdev Chand***, **Amit Khokher****, **Amit Jasrotia***, **A.K.Singh***, **Moni Gupta***, **M. Iqbal Jeelani****

**Sher-e-Kashmir University of Agricultural Sciences & Technology of Jammu, India-180009*

***Sher-e-Kashmir University of Agricultural Sciences & Technology of Kashmir, India-190025*

Purpose

The purpose of the paper "Unraveling the Relationship between Climate and Irregular Bearing of Red Delicious Apples in Jammu & Kashmir" is to investigate the impact of climate on the production of Red Delicious apples in the Jammu & Kashmir region. The study aims to establish a correlation between climatic variability and the irregular bearing of the apples, and to identify the specific climatic factors that are most strongly associated with this phenomenon. By doing so, the study seeks to provide insights that can help apple growers and policymakers in the region to develop better farming practices and improve the overall yield and quality of Red Delicious apples. The findings of this study are also expected to contribute to the broader field of agricultural research by shedding light on the complex relationship between climate and crop production.

Methods

The study was conducted over a period of five years and involved collecting and analyzing data from various apple orchards in the Jammu & Kashmir region. Firstly five apple orchards located in different parts of the region were identified, then monthly basis data using standard meteorological instruments on climatic factors like : temperature, rainfall, humidity, and sunshine hours were collected followed by monitoring of the fruiting patterns (number of flowers, fruit, and overall yield during each fruiting season) of the Red Delicious apple trees in the selected orchards. Correlation analysis was applied to access relationship between the climatic factors and the irregular bearing of apples, followed by linear regression models to examine the relationship between the climatic factors and the yield of apples for identification of specific climatic factors that are most strongly associated with irregular fruiting. Overall, the study employed a rigorous and comprehensive methodology to investigate the complex relationship between climate and the irregular bearing of Red Delicious apples in Jammu & Kashmir.

Results

The results show that high temperatures during the flowering stage and excess rainfall during the fruiting period are the main factors contributing to the irregular bearing of apples. The analysis also indicates that relative humidity does not have a significant impact on apple production in the region. Furthermore, the study identified the optimal temperature range during the flowering stage for the production of Red Delicious apples in Jammu & Kashmir. The analysis suggests that a temperature range of 15-25°C is suitable for optimal apple production. The research also indicates that excessive rainfall during the fruiting period can lead to fruit drop, resulting in lower apple yields. The results of the study provide insights into the impact of climate on apple production and can help farmers make informed decisions regarding the management of apple orchards. By understanding the relationship between climate and apple production, farmers can adopt appropriate agricultural practices, such as using protective measures during extreme weather conditions, to enhance apple yields and increase their economic benefits.

Conclusions

The study reveals the significant impact of climate factors such as temperature and rainfall on the production of Red Delicious apples in the region. The analysis indicates that high temperatures during the flowering stage and excess rainfall during the fruiting period are the

main factors contributing to the irregular bearing of apples. The research also identifies the optimal temperature range during the flowering stage and the potential negative impact of excessive rainfall on apple production. The findings of the study provide valuable insights into the relationship between climate and apple production in Jammu & Kashmir, which can help farmers make informed decisions regarding the management of apple orchards. By adopting appropriate agricultural practices based on the understanding of climate impact on apple production, farmers can enhance apple yields, improve the quality of the fruit, and increase their economic benefits. The research highlights the importance of understanding the impact of climate on agricultural production and the need for sustainable agricultural practices to ensure the long-term productivity and economic viability of apple orchards in the region. The study's results can also contribute to the development of climate-resilient agriculture, which is crucial to meeting the challenges of climate change and ensuring food security in the region.

Keywords: Climate, Irregular Bearing, Red Delicious Apples, Temperature, Precipitation,

Indoor air pollution level assessment in a tropical apartment building located at Bhubaneswar city

¹*Soma Kalia, ² Nibedita Mishra

¹ Department of Home Science, Ramadevi Women's University, Bhubaneswar- 751007, India

² Department of Home Science, Puri Women's College, Ramadevi Women's University, Bhubaneswar- 751007, India

Purpose

Sick house syndrome (SHS) causes by various unhealthy chemical concentrations and particulate matter present in indoor air. Also, the temperature and humidity of indoor air beyond and below the comfort zone is a reason for SHS. The consequence of indoor air pollutants is; irritation in nose, eyes, skin, throat and unusual tiredness. Therefore, it is important to find the indoor air quality.

Method

In this work, experiments were conducted to verify the pollution level of indoor air such as; volatile matters (VM), formaldehyde and particulate matters (PM 1.0, PM 2.5 and PM 10) in the houses of an existing apartment situated at Bhubaneswar city, India. Moreover, carbon monoxide (CO) and carbon dioxide (CO₂) concentrations in indoor air are measured. The temperature and humidity are also recorded. The experiments are conducted with door/window closed positions in February and May for a particular day at an interval of 3 hours. The results are compared with the measured outdoor air pollution level and maximum recommended value standardized by the world health organization (WHO).

Results

It is observed that CO and CO₂ concentration is higher than ambient conditions but less than the maximum limit value recommended by WHO regardless of the day of measure. On the other hand, the particulate matter concentration (PM 1.0, PM 2.5 and PM 10) both indoor and outdoor is higher than the safe value recommended by WHO irrespective of the day of measurement. However, in winter, the PM level is higher than the PM level observed in summer. Formaldehyde level is under the recommended limit both indoor and outdoor but the volatile matter concentration in indoor air is much higher than the recommended value and it is under the limit for outdoor air. Indoor temperature increases from 9 am to 3 pm and then decreases but the humidity continuously increases.

Conclusion From the measurement it is observed that PM level, CO, CO₂ and volatile matter concentration of indoor environment is higher than the recommended value. Hence, it is recommended for natural ventilation to reduce the pollutant concentration.

Keyword: indoor air quality, particulate matter, volatile, formaldehyde, temperature and humidity

Discovery of New Sources of Sheath Blight and Bacterial Leaf Blight Resistance Among Indigenous Rice Landraces

Praful Jaiswal¹, Bharat Raj Meena¹, Pardeep Kumar¹, Jameel Akhtar^{1*}, Rakesh Singh¹, Gyanendra Pratap Singh¹ & Ashok Kumar Singh²

¹ICAR-National Bureau of Plant Genetic Resources, New Delhi (India)

²ICAR-Indian Agricultural Research Institute, New Delhi (India)

Purpose

Rice (*Oryza sativa* L.) serves as the primary diet for approximately 67% of the world's population. Sheath blight (SB) caused by *Rhizoctonia solani* Kühn and Bacterial leaf blight (BLB) caused by *Xanthomonas oryzae* are one of the most serious diseases of rice. SB and BLB can reduce yield up to 50% and 80%, respectively and also reduce its quality. The wide host range and ability to remain dormant under unfavourable conditions make SB pathogen more difficult to manage. We aim to identify, among rice landraces, new sources of resistance against SB and BLB.

Methods

In the present study, 1500 diverse rice landraces were raised in two years 2021 and 2022 under pot experiment. A total of 1287 accession could get established and artificial inoculation was carried out with *R. solani* colonized typha pieces at the maximum tillering stage. Simultaneously, five plants each of raised accessions in the same pots were inoculated with *X. oryzae* suspension.

Results

The observation revealed that the incubation period for SB varied from 3-10 days. The relative lesion length for SB and BLB in relation to plant height was calculated which ranged from 5.92–79.76 % and from 0.80 – 66.72 %, respectively. According to 0-9 standard evaluation system (SES) scale (<20-R, 20-30-MR, 31-45-MS, 46-65-S and 65-HS>) for both the pathogens, there are three accessions viz., IRGC145, RL-2, and IRGC1745 showed resistance against sheath blight while ten accessions showed moderately resistant, viz., RL-3900, IRGC155, RL-664, RL-10067, RL-274, RL-127, IRGC295, RL-986, IRGC228 and IRGC288. The 5 accessions viz., RL26, RL155, RL274, RL241, IRGC404 were found resistant against BLB.

Conclusion

The resistant landrace accessions identified here can be exploited in rice breeding for developing SB and BLB resistant varieties.

Keywords: Rice, landraces, resistance, sheath blight, bacterial leaf blight

Stingless bee, *Tetragonula iridipennis* as a pollinator in capsicum under protected cultivation

Rakshitha T. N, Prabhu S. T., Dileep Kumar N. T., Sahana M. and Saleem Kannihalli

Department of Agricultural Entomology, College of Agriculture, University of Agricultural Sciences, Dharwad, Karnataka, India- 580005.

Purpose

Agricultural practices gradually evolved to rise the production and productivity of crops without expanding the area. One of the technologies to cope up with change in climatic condition is protected cultivation. The growth of protected cultivation in the world has driven crops from open field to protected environments, but this condition creates a physical barrier which prevents the access of natural pollinators to flowers. The most promising pollinator seems to be the stingless bees belonging to the super family Apoidea, family Apidae and sub family Meliponinae, because they have stunted vestigial sting that makes them safe for workers to carryout daily cultural practices in the confined environment.

Methods

The present study was carried out in greenhouses of Hi-tech Horticulture unit, Saidapur farm, University of Agricultural Sciences, Dharwad, Karnataka, India to know the efficiency of stingless bee, *Tetragonula iridipennis* Smith on pollination of capsicum crop cultivated under greenhouses during two seasons, summer (2021) and *rabi* (2021-2022). At the time of flower initiation three stingless bee colonies were introduced inside the greenhouse.

Results

The activity of foragers started at 07:00 h and continued up to 18:00 h with peak activity at 11:00 h to 12:00 h (12.90 bees/m²/10 min) during summer. In *rabi*, activity of bees started from 07:00 h till 18:00 h with peak activity at 11:00 h to 12:00 h (11.35 bees/m²/10 min). The floral handling time of stingless bees on flower in both the seasons, irrespective of the hours in a day the maximum flower handling time was observed in the afternoon hours (44.60 s/flower) compared to forenoon hours (20.57 s/flower). Even in often cross pollinated capsicum significant increase in number of fruits/plant (10.40 and 8.98), percentage of fruit set (90.04 % and 81.86 %), yield/plant (0.71 g and 0.46 g), fruit length (7.38 mm and 6.50 mm), fruit girth (22.86 mm and 19.43 mm), fruit weight (98.38 g and 83.08 g), TSS (5.20 % and 4.52 %), ascorbic content (93.64 mg/100 g and 89.15 mg/100 g) and moisture content (95.37 % and 40.93 %) was recorded between bee pollinated and control plots, respectively.

Conclusion

Stingless bees have contributed to crop pollination via increasing the yield and enhancing the quality of fruits. Despite of high selfing rates in capsicum, self-pollination led to inbreeding depression so, outcrossing with stingless bees, ameliorate fruit set and fruit quality under protected condition.

Keywords: Stingless bee, Capsicum, Foragers, Activity, Nectar, Pollen

Identification And Documentation Of The Views Of Farmers On Climate Change

Wakle P.K., Malkar S.D., Lambe S.P.³ and More S.D.

Department of Extension Education, Dr.Panjabrao Deshmukh Krishi Vidyapeeth, Akola (MS) India

Purpose

Climate change and agriculture are interrelated processes, both of which take place on a global scale (Parry *et al.*, 2007). Global warming is projected to have significant impacts on conditions affecting agriculture, including temperature. In India, climate change is putting additional stress on ecological and socioeconomic systems that are already facing tremendous pressures due to rapid urbanization, industrialization and economic development. India is considered to be especially vulnerable to the impacts of climate change. Like most other developing countries, people in India are dependent to a large extent on its natural resources for livelihood and economy. Any adverse impacts on these natural resources will have repercussion on the nation's livelihood security and economy and widen the gap between the rich and the poor. Considering this factual information the study on a 'Identification and Documentation of the views of Farmers on Climate Change' was planned and conducted.

Methods

The present investigation was carried out in Vidarbha region of Maharashtra State of India. Out of 11 districts Vidarbha region namely Yavatmal was selected for the study. For the purpose of study 6 villages from Yavatmal district were selected randomly. In this way, a total of 120 farmers were considered as respondents for a study. Ex-post facto research design was used for study. Data were collected through personal interview method with the help of structural schedule. Then the data was subjected to statistical analysis for interpretation.

Results

It is observed that a majority of farmers agree that there is increase in temperature as compared to previous years (61.67%), intensity of heat during summer has increased (55.00%), changes

in the timing of rainfall (49.16%), changes of high temperature and heat wave occurrence have increased (56.00%), duration of dry spell during rainy season increased (44.16%), rainfall decreased as compared to last year's (45.84%)

Conclusions

It is concluded that majority of respondents (85.83%) viewed that there is increases in temperature and changes in rainfall (80.84%) due to climate change. The (84.16%) percent respondents also strongly expressed that the increases in pest and disease is also due to occurrence of climate change (drought).

Keywords: Perception, Climate change

Harnessing native *Trichoderma* spp. to tackle major rice pathogens igniting relentless diseases

Kota Chakrapani, Bireswar Sinha, Bijeeta Thangjam, W. Tampakleima Chanu, K. Sarda Devi, Bathula Pooja, Zarzoliana Ralte, Baby Wangkhem

Department of Plant Pathology, College of Agriculture, Central Agricultural University, Imphal

ABSTRACT

Rice (*Oryza sativa*) is pre-eminent cereal crop around the world. Globally rice is consumed by more than three billion people. The consumption of rice is at utmost level by the world populace of tremendously developing low-income countries. Being most widely cultivated crop around the country and world, many fungal pathogens show their aggressiveness in attempt to inflict variety of diseases to the crop. Among which Blast, Sheath blight, Brown spot incited by *Pyricularia oryzae*, *Rhizoctonia solani*, *Helminthosporium oryzae* are in race to inflict losses to the growers. Today's Agriculture of 21st century is facing multifaceted problems in crop production of which tackling diverse pathogens is serious concern. To meet the needs the producers are employing chemicals to tackle these pathogens which are pose serious threats in number of ways. Use of these harsh chemicals have negative impacts on human, animal health and exerts high pressure on environment. In such case there is a need to devise a new management strategy to suppress the disease inflicting pathogens alongside safe to the environment. This can be served by the genus of *Trichoderma*. In the current investigation various Native *Trichoderma* spp. were isolated and identified by both morphologically and molecularly. ITS-1 and ITS-4 were used to identify the potential agents at molecular level. *T. asperellum* (MH257327), *T. harzianum* (MH257330), *T. asperellum* (KU933475), *T. asperellum* (KU933476), *T. asperellum* (KT601340), *T. atroviride* (KU933472), *T. harzianum* (KU933471), *Hypocrea lixli* (KX0113223), *T. koningiopsis* (KU904460), *T. harzianum* (KU933469), *T. harzianum* (KU933474) *Hypocrea lixli* (KX0113224), *T. harzianum* (KU933468), *T. harzianum* (KU904458) and *T. ovalisporum* (KU904456) isolates were identified. These isolates employed to identify the potential antagonism against the three pathogens. Among all the native *Trichoderma* isolates, *Trichoderma harzianum*, *Trichoderma asperellum* were found most potential in controlling the 3 pathogen.

Keywords: Blast, Sheath Blight, Brown Spot and Native *Trichoderma* spp.

Correlates of Profiles of The Farmers With Their Perception Towards Climate Change Wakle P.K.¹, Malkar S.D.², Lambe S.P.³ and More S.D.⁴

*Department of Extension Education, Dr.Panjabrao Deshmukh Krishi Vidyapeeth, Akola (MS)
India*

Purpose

Climate change is predicted by scientists to have the main impact on agriculture, economy and livelihood of the populations of developing countries and India is one of them, where large parts of the population depend on climate sensitive sectors like agriculture and forestry for livelihood. By adversely affecting freshwater availability and quality, biodiversity and desertification, climate change ends to disproportionately affect the poorest in the society, exacerbating in equities in access to food, water and health. The capacity to adapt is a function of access to wealth, scientific and technical knowledge, information, skills, infrastructure, institutions and equity and therefore varies among regions and socio-economic groups. Climate change therefore is intrinsically linked to other environmental issues and to the challenge of sustainable development. Considering this factual information the study on a 'Correlates of profiles of the farmers with their Perception towards Climate Change' was planned and conducted.

Methods

The present investigation was carried out in Vidarbha region of Maharashtra State of India. Out of 11 districts Vidarbha region namely Yavatmal was selected for the study. For the purpose of study 6 villages from Yavatmal district were selected randomly. In this way, a total of 120 farmers were considered as respondents for a study. Ex-post facto research design was used for study. Data were collected through personal interview method with the help of structural schedule. Then the data was subjected to statistical analysis for interpretation.

Results

It can be inferred the calculated co-relation co-efficient between perception of farmers and personal, socio-economic, communication and psychological characteristics revealed the following results which clearly indicates that selected characteristics of farmers i.e farming experience, economic motivation, access to weather forecast and view of farmers on climate change had positive and significant relationship at 0.01 % level of probability with perception of farmers, whereas, age, education, family size, occupation, land holding, annual income, cropping patterns had positive and significant relationship at 0.05 % level of probability,

Further, remaining characteristics of farmers such as family type did not establish significant relationship with their perception of farmers, hence, the null hypothesis was accepted with respect to these characteristics and concluded that these characteristics were not correlated with perception of farmers towards climate change.

Conclusions

It was found that, the independent variables like education, land holding, farming experience, cropping patterns, access to weather forecast and view of farmers towards climate change were found to be positively and highly significant with perception of farmers towards climate change. So it can be concluded that these variables play important role in adaption of factors of climate change.

Keywords: Perception, Climate change

Technological Gap In Recommended Ipm Practices Of Pigeon Pea

Tembhurne R. D.¹, Wakle P.K..², Koshti N.R..³ and More S.D..⁴

Department of Extension Education, Dr.Panjabrao Deshmukh Krishi Vidyapeeth, Akola (MS)
India

Purpose

Productivity of pulse crops is very low as India stands first in area but yield levels (529 kg/ha) is very low compared to the world average. The reasons for low productivity may be due to traditional methods of cultivation followed by the farmers. Productivity of crop can be enhanced by adopting the improved IPM practices as recommended by the research institutes and agricultural universities (Singh, 2002).

A wide gap exists between the available techniques and its actual application by the farmer which is reflected through poor yield in the farmers fields. There is a tremendous opportunity for increasing the production of red gram crop by adopting the improved technologies. *Yield level of farmers may be increase by finding technological gap in adoption of recommended IPM practice for pigeon pea cultivation.* Considering this factual information the study on a '*Technological gap in recommended IPM practices of pigeon pea*' was planned and conducted.

Methods

The present investigation was carried out in Vidarbha region of Maharashtra State of India. Out of 11 districts Vidarbha region namely Yavatmal was selected for the study. For the purpose of study 6 villages form Yavatymal district were selected randomly. In this way, a total of 120 farmers were considered as respondents for a study. Ex-post facto research design was used for study. Data were collected through personal interview method with the help of structural schedule. Then the data was subjected to statistical analysis for interpretation.

Results

From present study, it was found that *two third of respondents (64.00 %) were observed under medium category of technological gap of recommended IPM practices of pigeon pea considerable higher percentage of respondents (86.14 %, 70.83 % and 70.00%) were belonged technological gap respectively. 33.43 per cent, 27.08 per cent and 39.58 per cent of respondents were also found in low medium and high category as regards to recommended seed rate and variety. (14.59%, 12.50%, 72.91%) maximum percentages of respondents were observed in low, medium and high technological gap in recommended Seed treatment practices. (63.51%) in high, (28.24%) in medium and (9.24%) in low category of technological gap.*

Conclusions

So it can be concluded that more than one third technological gap was found in *recommended seed rate and variety* .

Keywords: *Technological gap, pigeon pea*

Correlates Of Profiles Of The Farmers With Technological Gap Of IPM In Pigeon Pea**Tembhurne R. D.¹, Wakle P.K..², Kale N.M.³ and More S.D.⁴***Department of Extension Education, Dr.Panjabrao Deshmukh Krishi Vidyapeeth, Akola (MS) India***Purpose**

IPM as applied in agriculture is the most ideal as it is economical, safest, ecologically sustainable and sociologically acceptable combination of physical, chemical and biological methods to limit the harmful effects of crop pests. The need for IPM. As Jayraj (1996) puts it, arises due to the heavy dependence of farmers on chemical pesticides and their indiscriminate use which has resulted in the development of resistance in pests to pesticides, resurgence of target and non-target pests, destruction of beneficial organisms like honeybees, pollinators, parasitoids and predators. In this context, there has been a considerable global awareness on the toxicity problems of chemical pesticides and on the need for evolving more and more non-chemical methods of pest control in the overall concept of IPM. Considering this factual information the study on a 'Correlates of profiles of the farmers with technological gap of integrated pest management practices' was planned and conducted.

Methods

The exploratory research design of social research was used in the present investigation. The sample was drawn from Akola Panchayat samiti and Murtijapur panchayat samiti of Akola district of Maharashtra state. From each samiti 6 villages were selected on the basis of large area under pigeon pea crop. Thus, 120 farmers constituted the sample for the study, Data were collected by personally interviewing the respondents with the help of pretested and structured interview schedule. The data collected were tabulated and the statistical tools namely mean, standard deviation, percentage, frequency and correlation coefficient were employed for interpretation of the findings.

Results

It is observed from the study that the selected variables, land holding, area under pigeon pea, and innovativeness were positively and significantly correlated with technological gap at 0.05 level of probability. Therefore, the null hypothesis was rejected, for these characteristics shows that there exists significantly relation with technological gap of recommended IPM practices pigeon pea.

The selected variables, annual income, social participation cropping pattern and economic motivation negatively but significantly correlated with technological gap at 0.05 level of probability. Therefore, the null hypothesis was rejected, for these characteristics shows that there exists negative significantly relation with technological gap of recommended IPM practices pigeon pea.

Conclusions

It was found that, the independent variables like land holding, area under pigeon pea, innovativeness were found to be positively and highly significant with technological change. So it can be concluded that these variables play important role in adaption of IPM.

Keywords: Technological gap, IPM

Constraints Faced By Farmers In Adoption Of Improved Cultivation Practices Of Gram**Khare A.L.¹, Wakle P.K.², Mankar D.M.³ and Salame S.P.⁴***Department of Extension Education, Dr.Panjabrao Deshmukh Krishi Vidyapeeth, Akola (MS) India***Purpose**

Improved agricultural practices are the product of modern science and technology. Development of new technologies is generally not major problem in country, the main problem as exist today is that of diffusion and acceptance of these techniques by the farmers. Though chickpea is assuming prime important in oilseed and pulse crop among the farming community, there exist a wide gap between average yield of common farmers and actual potential of crop. It will be very useful to ascertain the factors responsible for adoption gap. The reasons leading to adoption gap of chickpea cultivation will also be useful to evolve conceptual model of chickpea production technology. Considering this factual information the study on a 'constraints faced by farmers in adoption of improved cultivation practices of gram' was planned and conducted.

Methods

The present investigation was carried out in Vidarbha region of Maharashtra State of India. Three Panchayat Samities of Akola district namely Akola, Barshitakli and Akot, in Vidarbha region of Maharashtra state, where the gram cultivation was comparatively on large area. From those Panchayat Samiti ten respondents were selected from each village by random sampling method, making a sample size of 120 in total.

Results

It is observed that majority 81.66 per cent of the respondents reported that they have very less knowledge about scientific plant protection measures. While 74.16 per cent of respondents reported that they have less unavailability of chemical fertilizers in season followed by 71.66 and 70.83 per cent of respondents had Lack of knowledge about seed treatments and High cost of pesticides and insecticides.

The majority of the respondents 68.33 per cent faced the constraint of lack of scientific knowledge about FYM preparation. Followed by 66.66 and 65.00 uncertainty of rainfall and High prices of improved seeds. The other constraints like less information about recommended varieties (62.50), unavailability of seed within time (58.33%), and unavailability of laborers (58.33%).

Conclusions

It could be concluded that a lack of information about appropriate insecticide/ pesticides, lack of knowledge about pest and diseases resistant variety, lack of knowledge about seed treatments, unavailability of chemical fertilizers in season were the main constraints in adoption of improved cultivation practices of gram.

Keywords: *Constraints, Gram*

Constraints Faced By The Nursery Growers**Wadkar A.R.¹, Wakle P.K.², and Shambharkar Y.B.³***Department of Extension Education, Dr.Panjabrao Deshmukh Krishi Vidyapeeth, Akola (MS) India***Purpose**

Nursery raising is one of the highly economic enterprise in horticulture sector. The nursery management gained status of commercial venture as the demand for high quality planting material is steadily increasing due to interest in vegetable gardening, fruit tree cultivation, social forestry, agro-forestry and plantation crops. The need of setting up plant nurseries to meet the demands of the people has been felt by small and marginal farmers as well as by gardeners and farmhouse owners. In order to meet, this demand, there is ample scope for introduction of small nurseries, which will serve to augment the income of needy section of rural society. It is observed that the farmers are not diverting to start nursery as enterprise due to no. of problems. Considering this factual information the study on a 'constraints faced by the nursery' was planned and conducted.

Methods

The present investigation was carried out in Vidarbha region of Maharashtra State of India. Three Panchayat Samities of Akola district namely Akola, Barshitakli and Akot, in Vidarbha region of Maharashtra state, where the gram cultivation was comparatively on large area. From those Panchayat Samiti ten respondents were selected from each village by random sampling method, making a sample size of 120 in total.

Results

It is observed that majority of the respondents reported that it was difficult in getting technical know-how and did not get information in time. While, 19.38 per cent entrepreneurs faced the problem of bank delay in getting the loan, the 12.92 per cent raised the problem of unavailability of market and the problem of more taxes in metropolitan city. It is also noted that majority of the nursery growers faced the problems like non availability of fertilizers and insecticides in time (68.33 per cent) non-availability of plant protection appliances (13.33 per cent) and high cost of seeds, fertilizers.

Conclusions

It could be concluded that a lack of information about appropriate nursery growing technical know how is the major constrains faced in nursery growing.

Keywords: *Constraints, Nursery*

Deciphering the role of *OsPLDα2* gene for haploid induction ability in rice using CRISPR/Cas9 based genome editing**Lakshay Goyal, Khushnoor Singh Brar, Meghna Mandal, Vanshika Sharma, Tanu Sri, Dharminder Bhatia****Punjab Agricultural University, Ludhiana, India-141004***Background**

Doubled haploid (DH) breeding can aid in rapid fixation of recombinants which is otherwise a time-consuming process. It involves chromosome doubling of haploid plants generated by various *in-vitro* and *in-vivo* methods. Haploid inducer stock (HIS) is an *in vivo* method which is widely used in maize to produce haploids. The genetic basis of this HIS is extensively studied in maize and several haploid inducing genes have been identified. Recently, *ZmPLD3* has been reported as another important gene for inducing haploids in maize (Li et al, 2021). Orthologue of *ZmPLD3*

has been found to be conserved among different species and therefore its orthologue in rice could play a putative role in haploid induction. Here in this study, we have tried to decipher the role of *OsPLD3*, an orthologue of *ZmPLD3* with the help of CRISPR/Cas9 based GE.

Material and methods

The *LOC_Os05g07880 (OsPLD α 2)* was confirmed as an orthologue of *ZmPLD3* based on phylogenetic and *in silico* sequence analysis. Two guide RNA (sgRNAs) were designed from second exon of the *LOC_Os05g07880 (OsPLD α 2)* and was further checked for its structure using RNAfold web server. Primers were designed for multiplexed cloning in pRGEB32 vector which is based on polycistronic tRNA-sgRNA cassette (PTG) system. After successful cloning, the pRGEB32-PLD were mobilised into *Agrobacterium* LBA4404 strain. Twenty-one days old callus derived from seeds of genotype “Taipei” was transformed with *Agrobacterium*. Transformed calli were placed on selection media (hygromycin) for three consecutive cycles of fifteen days each. After completion of selection cycles, the selected secondary calli were placed on regeneration media supplemented with NAA and BAP. Regenerated plants were transferred on rooting media and thereafter transferred in pots. DNA was extracted from regenerated plants for screening with Cas9 primers.

Results

The sgRNAs were cloned in pRGEB32 vector according to Xie et al (2015). Firstly, several fragments were amplified using pGTR vector. Further golden gate assembly with simultaneous digestion and ligation was used to generate a PTG cassette. This PTG cassette was further amplified and ligated in pGEMT vector. These pGEMT clones were sequenced to confirm the cloning of sgRNAs. Further, FokI enzyme (site present in assembled PTG cassette) was used to release the desired fragment from positive clone. This fragment was then ligated in to pRGEB32 vector to develop the final construct. After *Agrobacterium* mediated transformation, hygromycin selection and regeneration, we were able to get twenty-nine plants (Fig. 1). These twenty-nine plants were screened for Cas9 primers to reveal the T-DNA integration and we found nine positive plants for T-DNA integration. These plants will be further validated for targeted edits and haploid induction frequency.

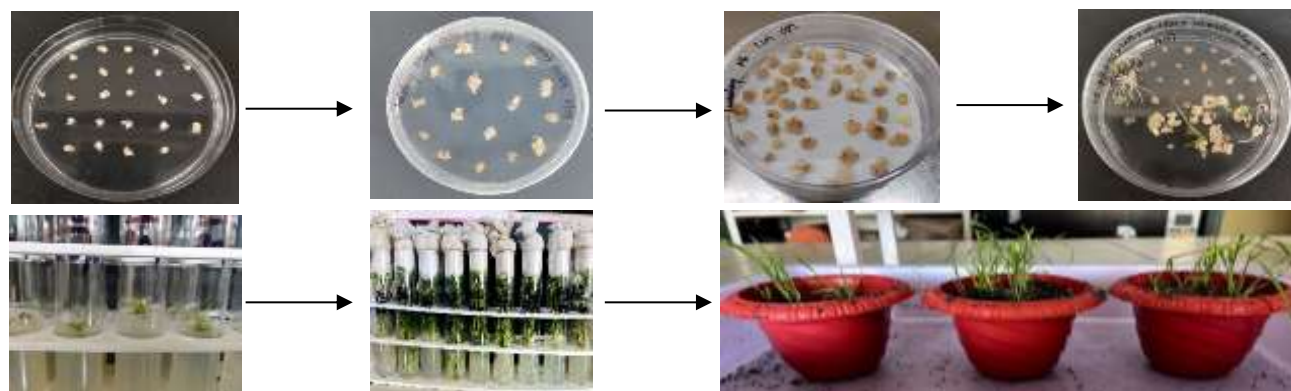


Fig 1: Workflow used to develop putative *OsPLD α 2* gene edited plants in rice

Loss of function mutation in *ZmPLD3* is known to induce haploids in maize. *LOC_Os05g07880* has been found to be an orthologue of *ZmPLD3* on the basis of its sequence similarity. In this study,

LOC_Os05g07880 has been targeted with the help of CRISPR/Cas9 based genome editing approach with the aim of developing haploid inducer stock in rice. We got nine positive plants among twenty-nine plants on the basis of preliminary screening with Cas9 primers. Furthermore, its accurate phenotyping along with sequencing will reveal the role of this gene in haploid induction.

Keywords: *OsPLD3*, Haploid induction, Doubled haploids, Genome editing, Haploid inducer stock

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Study On Seed Quality Enhancement, Storability And Field Performance Of Kabuli Chickpea Varieties

Jolli R B¹, Roopashree B² and Sadhana R. Babar³

^{1&2}*Department of Seed Science & Technology, College of Agriculture, Vijayapur, UAS, Dharwad, Karnataka, India*

³*AICRP on Pearl millet, Regional Agricultural Research Station, Vijayapur, UAS, Dharwad, Karnataka, India*

Purpose

Chickpea (*Cicer arietinum* L.) is an important legume, which belongs to the genus *Cicer*, family *Fabaceae*. There are two kinds of chickpea viz., *desi* and *kabuli* grown in the world. *Kabuli* type is grown in temperate region, while the *desi* type chickpea is grown in the semi-arid tropics. It is evident that, all pulses are susceptible to storage pests and diseases. As *kabuli* chickpea seeds are bigger in size, they have exceptionally thin and smooth seed coat conjointly has high protein and sugar contents which make them profoundly vulnerable to storage pests and pathogens. If seeds are exposed to high temperature and high humidity, the frequency of incidence of micro flora is mainly responsible for the degradation of protein and other food reserves resulting in reduction in viability, vigour and germination. Seed is an efficient media for survival and dissemination of pathogens and pests. So, to reduce the losses and save the viability for longer time, it is advisable to coat the seeds with polymer and chemicals. The treatment of seed with bioagents is safe, economical, eco-friendly and cheap. The detailed information on these concepts of chickpea is lacking. Hence, an investigation was carried on to study the “Investigations on seed quality enhancement, storability and field performance of *kabuli* chickpea varieties” with the following objectives.

Objectives

To study the influence of polymer coating, chemical and castor oil treatment on seed quality of *kabuli* chickpea varieties during storage.

To study the influence of polymer coating, chemical and bioagent treatment on field performance of *kabuli* chickpea varieties.

Materials And Methods

Source of seeds: The *kabuli* chickpea varieties viz., KAK 2 and MNK 1 were obtained from plant breeder AICRP on Dryland Agriculture, RARS, Vijayapur. The seeds were dried under shade for three to four days to bring the seed moisture level to 8 %.

Design of the experiment: The laboratory experiment was conducted under completely randomized design (FCRD) in factorial concept with four replications.

Treatment details: Factor –I: Varieties (V) V₁: KAK 2 V₂: MNK 1

Factor - II: Seed treatments (T)

T₁: Control (untreated)

T₂: Polymercoat @ 10 ml/kg of seeds

T₃: Polymercoat @ 20 ml/kg of seeds,

T₄: Vitavax power @ 3 g/kg of seeds (Carboxin 37.5 % + Thiram 37.5 %)

T₅: Vitavax power @ 3 g/kg of seeds + Polymercoat @ 10 ml/kg of seeds

T₆: Vitavax power @ 3 g/kg of seeds + Polymercoat @ 20 ml/kg of seeds

T₇: Castor oil @ 10 ml/ kg of seed

Methods of storage: The seeds after treating with polymer and chemical were dried back to their original moisture content and stored in cloth bag in the laboratory of Department of Seed Science and Technology, College of Agriculture, Vijayapur. During 2018-19



Plate 1 Seed treatment with fungicide, polymercoat and castor oil on Kabuli chickpea var. KAK2 and MNK 1

RESULTS:

Significantly, the higher vigour index was seen at initial and nine month of storage period (3198 and 2470, respectively) in MNK 1 (V₂) and it was followed by KAK 2 (V₁) (3062 and 2331, respectively). Significantly higher vigour index (3153) was recorded at first month in T₆ (vitavax power @ 3 g/kg seed + polymercoat @ 20 ml/kg of seeds) followed by T₅ (vitavax power @ 3 g/kg seed + polymercoat @ 10 ml/kg of seeds) as 3124. While significantly lower vigour index (3023) was recorded in T₁ (untreated). Seed coated with the polymer combined with fungicide gave better results due to good germination percentage. These results are in conformity with the findings of Baig (2005) in soybean and Kaushik *et al.* (2014) in maize.

Significantly, the maximum protein content at initial and nine month of storage period (21.42 and 17.78 %, respectively) was recorded in MNK 1 (V₂) and it was followed by KAK 2 (V₁) (20.30 and 16.75 %, respectively). Due to seed treatments, the significant difference in protein content was recorded from third month to ninth month of storage period. Significantly maximum protein content (19.94 %) was noticed at 3rd month in T₆ (vitavax power @ 3 g/kg seed + polymercoat @ 20 ml/kg of seeds).

KAK 2 (V₁) recorded significantly higher seed yield (25.92 q) per hectare compared to MNK 1 (V₂) as 15.24 q. Among the seed treatments, T₈ (vitavax power @ 3 g/kg + polymercoat @ 20 ml/kg + *Pseudomonas fluorescense* @ 30 g/ kg of seeds) recorded significantly higher seed yield per ha⁻¹ (22.50 q) and it was followed by T₇ (vitavax power @ 3 g/kg + polymercoat @ 10 ml/kg + *Pseudomonas fluorescense* @ 30 g/ kg of seeds) as 21.95 q and minimum seed yield per hectare was found in the T₁ (control) as 17.87 q.

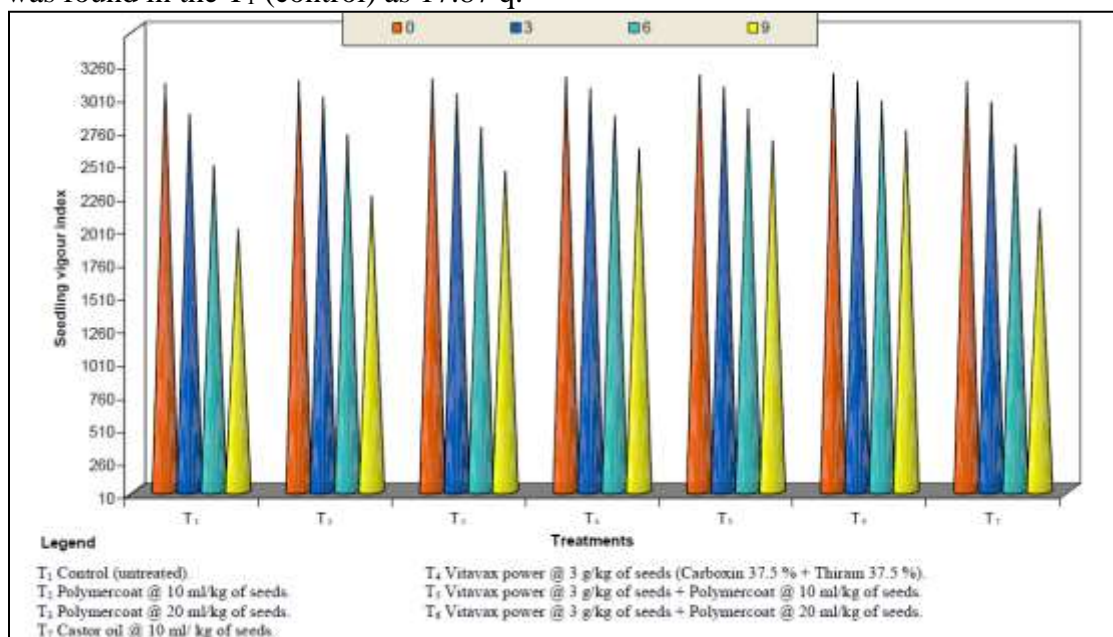


Fig. 1 Effect of polymer coating , chemical treatment and castor oil on seedling vigour index of *Kabuli* chickpea during storage

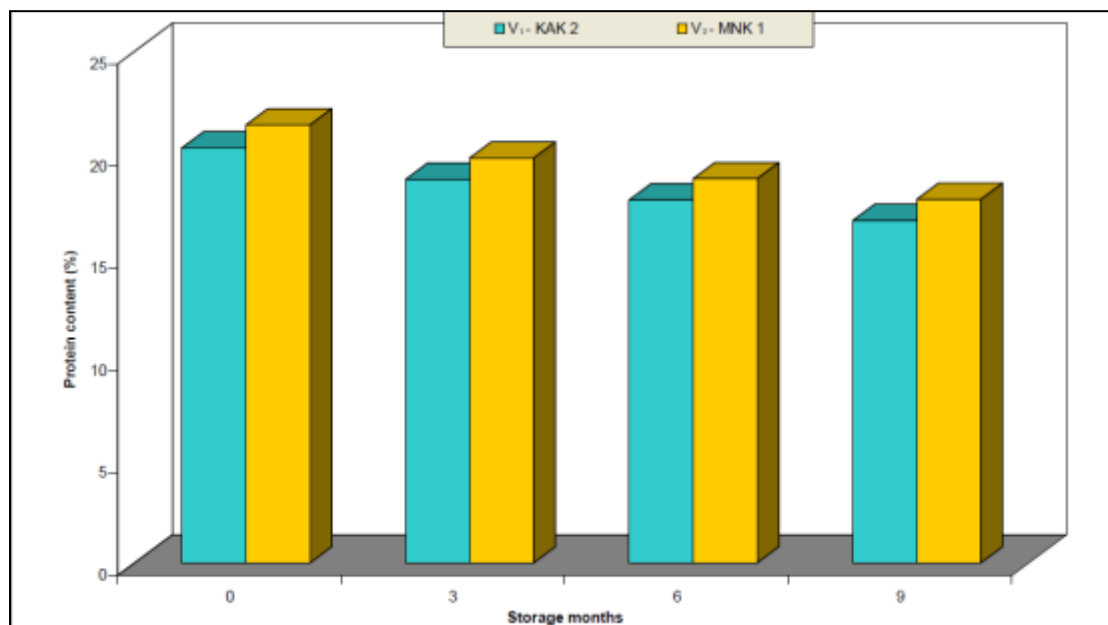


Fig. 2 Effect of storage period on protein content of *Kabuli* chickpea varieties

Conclusion:

Variety MNK 1 seeds store better during a period of storage with good seed quality than the KAK 2. Large quantity of seed can be stored for longer period, with superior seed quality by treating the seeds with vitavax power @ 3 g/kg seed+ polymer seed coating @ 20 ml/kg of seeds and when sown in the field along with *Pseudomonas fluorescence* @ 30 g/ kg of seeds treatment gave the good seed yield coupled with higher seed quality and net returns.

Referebces:

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Study On Seed Mycoflora, Field Performance And Storability Of Green Gram (*Vigna radiata* L.)

Jolli R B¹, Heena Kouser H M² and Sadhana R. Babar³

^{1 & 2}Department of Seed Science & Technology, College of Agriculture, Vijayapur, UAS, Dharwad, Karnataka, India

³AICRP on Pearl millet, Regional Agricultural Research Station, Vijayapur, UAS, Dharwad, Karnataka, India

Purpose

Green gram [*Vigna radiata* (L.) Wilczek] is an important pulse crop belongs to the *Leguminosae* family and sub-family *Papilionaceae*. It is commonly referred to as mung bean, mung, moong or golden gram. Among the pulses, green gram is one of India's most significant short-duration pulses. The seeds are highly nutritious as it contains about 23.86% protein. Seed borne pathogens have ability to kill the seedling or plants and substantially reduce the productive capacity (Rahaman *et al.*, 1999). Coating seed with polymers as protective chemicals enhances emergence

of seedlings and plant establishment in the field. The polymer coat helps to make room for nutrients, protectants, plant growth promoters, hydrophobic/hydrophilic substances, oxygen suppliers *etc.* Seed treatment with bioagents is safe, economical, eco-friendly and cheap. The higher seed yield and better quality seed can be produced by treating the seeds with polymers, fungicides. Seed storage is an important post-harvest operation that decides the success of quality seed characterized by higher viability and vigour (Yaklich *et al.*, 1979). Keeping these in view, the present investigation entitled the influence of polymer coating, fungicides and bioagents on growth performance, seed yield and seed quality in field condition with the following objectives.

Objectives

To study the influence of polymer coating, fungicides and bioagents on field performance of green gram.

To study the influence of polymer coating, fungicides and bioagents on seed quality during storage of green gram.

Materials and methods:

Design: RCBD (Randomized Complete Block Design)

Treatment details:

T₁: Control (untreated), T₂: Polymercoat @ 3 ml/kg of seeds, T₃: Carbendazim @ 2 g/kg of seeds, T₄: Carboxin 37.5 % + Thiram 37.5 % (Vitavax Power) @ 3 g/kg of seeds, T₅: Carbendazim 12% + Mancozeb 63% (Saaf) @ 3 g/kg of seeds, T₆: Polymercoat @ 3 ml/kg of seeds + Vitavax Power @ 3 g/kg of seeds, T₇: Polymercoat @ 3 ml/kg of seeds + Saaf @ 3 g/kg of seeds, T₈: Polymercoat @ 3 ml/kg of seeds + Vitavax Power @ 3 g/kg of seeds+ *Pseudomonas fluorescens* @ 30 g /kg of seeds, T₉: Polymercoat @ 3 ml/kg of seeds+ Saaf @ 3 g/kg of seeds + *Pseudomonas fluorescens* @ 30 g /kg of seeds

Methods of storage: The seeds after treating with polymer and chemical were dried back to their original moisture content and stored in cloth bag in the laboratory of Department of Seed Science and Technology, College of Agriculture, Vijayapur. During 2019-20

Results And Discussion

The seed treatments, Polymercoat @ 3 ml/kg + Saaf @ 3 g/kg + *P. fluorescens* @ 30 g/kg of seeds was found effective for improving the field emergence (98.67 %) followed by Polymercoat @ 3 ml/kg + Vitavax Power @ 3 g/kg + *P. fluorescens* @ 30 g/kg of seeds (97.33 %) which were significantly superior to other treatments. This might be due to suppression of the activity of soil borne pathogens or fungi by seed treatment and improved seed germination, vigour Whereas, untreated seeds recorded minimum field emergence and significantly inferior to polymercoat, fungicides and bioagents seed treatments. Similar findings were confirmed earlier by Dubey *et al.* (2011) in mung bean who noticed an increase in seed germination due to combined seed treatment of *Trichoderma virens* and carboxin in green gram under field conditions.

The fungicide treated seed prevent soil borne pathogens from seedling infections besides enhancing seed germination and seedling vigour of the host plants. Similar observations were also reported earlier by Sunil Kumar (2004) in soybean and Dolas *et al.* (2018) in green gram.

There was a significant improvement in seed yield per hectare (Fig 6) in the seed treatments with polymercoat @ 3 ml/kg + Saaf @ 3 g/kg + *P. fluorescens* @ 30 g/kg of seeds (695 kg) as compared to untreated control (508 kg). The increased yield was attributed to better plant establishment with suppression of seed borne diseases. Similar studies were conducted by Narayanan *et al.* (2017) in black gram reported that seeds fortified with MgSO₄ + polykote + carbendazim + dimethoate + bioinoculant (*P. fluorescens*) + *Rhizobium* + Azophos + pelleting with DAP recorded higher seed yield and other parameters when compared to control.

Polymercoat @ 3 ml/kg + Saaf @ 3 g/kg + *P. fluorescens* @ 30 g/kg of seeds recorded the higher vigour index (3462) over all other treatments and the lowest values (2952) were with untreated. The results on economics of seed production due to seed treatments revealed that significantly highest gross returns (Rs. 34,780 ha⁻¹), net returns (Rs.19,478 ha⁻¹) and B:C ratio 2.27 were obtained in Polymercoat @ 3 ml/kg + Saaf @ 3 g/kg + *P. fluorescens* @ 30 g/kg of seeds as compared to control that recorded lower gross returns (Rs. 25,405 ha⁻¹), net returns (Rs. 10,200 ha⁻¹) and B:C (1.67).

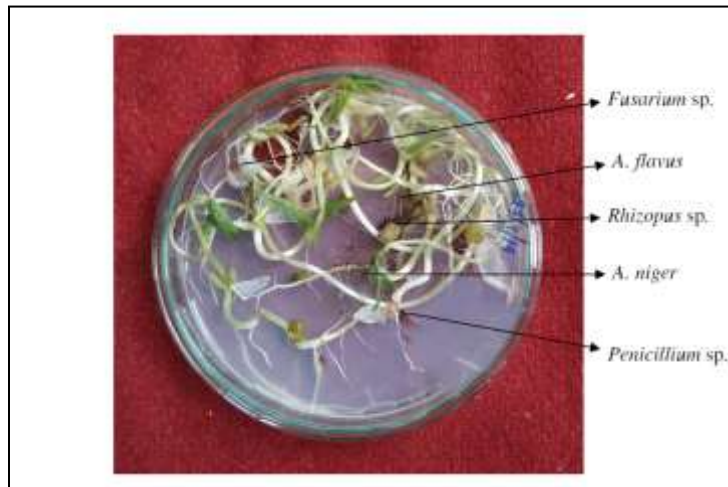


Plate 2: Seed mycoflora associated with green gram detected by water agar method



Plate 3: Seed mycoflora associated with green gram detected by blotter method

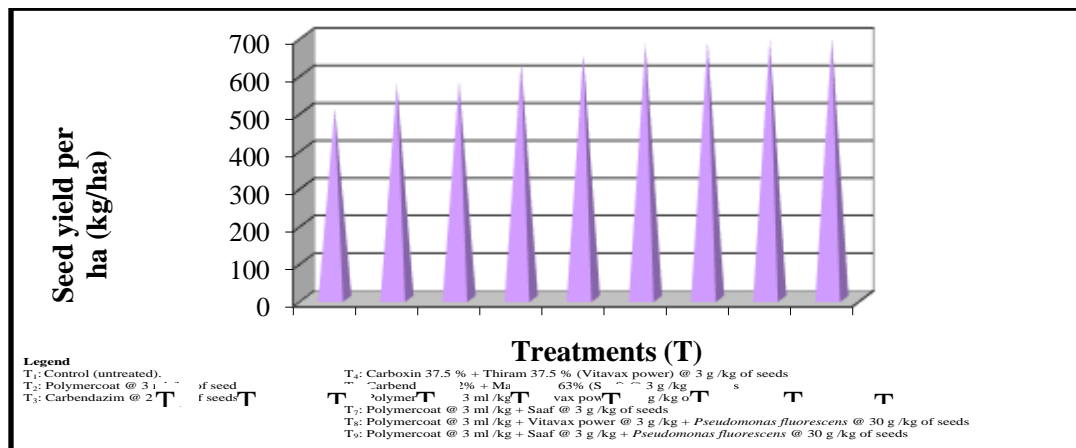


Fig. 1 Influence of polymer coating, fungicide and bioagent treatment on seed yield (kg/ha) of green gram

Conclusion: Combined seed treatment with polymercoat @ 3 ml/kg + saaf @ 3 g/kg + *Pseudomonas fluorescens* @ 30 g/kg of seeds gave the good seed yield coupled with higher seed quality and net returns.

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Evaluation Of Insecticides Against Hopper And Thrips Of Mango

D. M. Damasia, J.J. Pastagia, H.R. Kachhela

College of Agriculture, Navsari Agricultural University, Waghai-394730, Dist-Dangs, Gujarat, India

Purpose

Mango is an important fruit crop of India and cultivation of mango is increasing day by day. More than 200 insect pests have been identified to infest (Srivastava, 2000). Out of these, about 12 insect pests harshly damage different parts of mango tree. Mango hopper and thrips are serious pest during flowering and fruiting stage of mango and pose heavy yield losses.

Methods

To evaluate the efficacy of insecticides against hoppers and thrips field trials was conducted during December 2018 to November 2020 at HMRS, Waghai (Gujarat) with seven

treatments, replicated thrice in CRD. The insecticidal treatments were applied with the help of rocker sprayer at panicle emergence and subsequent at ETL of pest. The pre and post treatment observations were recorded before twenty four hour and after weekly interval of insecticidal spray, The hopper and thrips population was recorded on randomly selected and tagged ten twigs (during vegetative stage) and ten panicles (during flowering stage).

Results

Based on the collective results, populations of hopper and thrips were remained non-significant among all the treatments including control before imposition of treatments in the experimental plots. All treatments were remained significantly superior over control at different post spray intervals. Lowest hopper population was recorded in thiamethoxam 0.0084 % among the different insecticides (1.70hoppers/panicle) and which was statistically at par with imidacloprid 0.005% (1.80/hopper/panicle) and lambda cyhalothrin 0.005% (1.80 hopper/panicle). Significantly lowest thrips population was recorded in thiamethoxam 0.0084 % among the different insecticides (1.11 thrips/panicle) which was at par with imidacloprid 0.005% (1.35 thrips/panicle).

Conclusions

thiamethoxam 0.0084 % was found most effective for management of hopper and thrips which was statistically at par with imidacloprid 0.005% and lambda cyhalothrin 0.005%. The treatment thiamethoxam 0.0084 % recorded significantly highest number of fruits and yield (230.89 fruit/tree and 6189 kg/ha) which was statistically at par with imidacloprid 0.005% and lambda cyhalothrin 0.005%. While, maximum ICBR was recorded in thiamethoxam 0.0084 % (1:21.04) followed by imidacloprid 0.005% (1:19.52) and lambda cyhalothrin 0.005% (1:18.33).

Keywords: Hopper, insecticide, panicle, thrips

Synthesis of some new heterocyclic derivatives with possible local Anaesthetic activity:

Roopali Tandon, Giraj Singh, S.C. Mehra

Department of Chemistry, Bareilly College Bareilly

Purpose :

Some new derivatives of 2- amino-5-(N¹⁰- Phenothiazinomethyl) – 1,3,4 – Thiadiazole were prepared by their reaction with chloroacetyl chloride followed by condensation with various amines and their local anaesthetic activity were evaluated. The local anaesthetic activity was enhanced by having an amide group in the intermediate chain. It was also observed that compound possessing dialkyl amino alkyl group linked to an aromatic or heterocyclic nucleus as the lipophilic moiety confer not only the enhanced activity but also exhibit less toxicity than the analogues.

Method :

2- Amino -5-(N¹⁰–Phenothiazinomethyl)- 1,3,4 – thiadiazole has been synthesis from 2- Amino -5-(N¹⁰–Phenothiazinomethyl)- 1,3,4 – thiadiazole and chloroacetyl chloride in presence of K₂CO₃ which on treatment with morpholino gone 2- Amino -5-(N¹⁰–Phenothiazinomethyl)- 1,3,4 – thiadiazole. Similarly various thiadiazole derivatives were prepared and were screened for their local anaesthetic activity

Result :

The Local anaesthetic activity of newly synthesized compounds were evaluated by various methods (TLC) and Structure of compound were established by IR and PMR.

The results were compare with that of standard compound procaine hydrochloride and the compounds were tested as their hydrochloride . The compound prepared exhibit better activity

than procaine hydrochloride and the compound 2- [N – Morpholino acetamido] 5-(N¹⁰ – Phenothiazinomethyl)- 1,3,4 – thiadiazole has been found to be most active.

Conclusion :

It may be concluded that the activity is enhanced by having an ester or an amide group in the intermediate alkyl chain and the aromatic/ heterocyclic nuclei as the lipophilic moiety confer greater activity and less toxicity.

Keywords : TLC , Local Anaesthetic activity , thiadiazole, IR, PMR.

Effect of Pre-Harvest Treatments on Biochemical Attributes of Sapota Cv. Kalipatii

Jadhav P. J., Pandey A. K., Goswami A. K., Ingole A. D.

Division of Fruits and Horticultural Technology, IARI, New Delhi.

Purpose

Sapota botanically “berry” belongs to family sapotaceae. India is the largest producer of sapota in the world but, being a climacteric fruit, it has short post-harvest life of 4-7 days after harvesting because of high ethylene and respiration rate. During the ripening rapid bio-chemical changes reduces the shelf life. The application of pre-harvest agrochemicals is considered as most innovative method to extend the storage life of fruits including sapota.

Methods

The experiment was conducted at Navsari Agriculture University, Navsari on 31 years old trees. Different combinations of pre-harvest treatments of salicylic acid and calcium chloride were applied in two seasons *i.e.*, Winter (Season-1) and Summer (Season-2) (Table 1). Observations were recorded after harvesting at three ripening intervals (3, 6, and 9 days). Data analysis was done in SPD (in CRD) by taking period as subfactor in periodical parameters.

Table 1. Spraying frequencies of different treatments

S. N.	Seasons	Spraying Time
1.	Season-1 (Oct.-Nov.)	Salicylic acid was sprayed in the first week of October
		CaCl ₂ was applied in second week of November
2.	Season-2 (Jan.-Feb.)	Salicylic acid was sprayed in the first week of January
		CaCl ₂ was applied in second week of November

Results

Pre-harvest treatments significantly affects the phenols and sugars metabolism during ripening. Treatment 2000 ppm Salicylic acid + 1.5 % CaCl₂ recorded highest phenol content during winter (137.27, 133.54 and 114.63 mg 100g⁻¹ of fresh wt.) and summer (136.91, 131.82 and 111.98 mg 100g⁻¹ of fresh wt.) at 3rd, 6th and 9th days of storage, respectively. Same treatment recorded significantly higher total sugars, reducing sugars and non-reducing sugars during winter (18.24, 21.08 and 19.82 %; 10.57, 12.38 and 11.38 %; 7.67, 8.70 and 8.44 %, respectively) and summer (18.13, 20.94 and 19.75 %; 10.49, 12.29 and 11.26 %; 7.64, 8.65 and 8.49 %, respectively) at 3rd, 6th and 9th days of storage, respectively. The interaction effect of treatments and periods was found non-significant with respect to all parameters during both seasons *viz.*, winter (season-1) and summer (season-2).

Conclusion

Treatment combination with 2000ppm salicylic acid and 1.5% calcium chloride found superior in total phenols and sugars during both seasons.

Keywords-

Sapota; Shelf life; Pre-harvest; Salicylic acid; Calcium chloride

Assessment of greenhouse gas emissions (CO₂, CH₄, N₂O) from Integrated farming systems in Western Vidarbha- Maharashtra**D. S. Kankal***, J. P. Deshmukh, B.V. Saoji, B. S. Morwal, S. M. Bhoyar, V. K. Kharche, P. W. Deshmukh, A. B. Age, M. M. Ganvir and P. H. Bansod*Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra, India- 444104***Purpose**

Atmospheric CO₂ level has increased to 415.26 ppm as of today from a pre-industrial level of around 280 ppm contributing to climate change and a rising global temperature. The GHG emissions from agriculture and allied sectors are mainly CO₂, CH₄, and N₂O through deforestation, burning of residues, use of pesticides, fertilizers and so on, accelerate global warming. Integrated Farming System (IFS) model for small and marginal farmers can help to reduce the GHG emissions and other environmental impacts from agriculture.

Methods

The study was conducted at research farm of Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra, India during 2017-18 to 2021-22 to measure and evaluate the greenhouse gas emissions (CO₂, CH₄ and N₂O) from different components of IFS irrigated model of 1.00 ha from Western Vidarbha. IFS-GHG estimator-Version-1.1 developed by IIFSR, Modipuram based on Default country specific or IPCC emission factors (CO₂ equivalent per kg of N or per litre fuel) has been used for calculating GHG emission.

Results

The results demonstrated that, the mean sinking of GHG was recorded 8796 kg CO₂ equivalents against total emission of 2964 kg CO₂ equivalents which showed net mean GHG balance of – 5832 kg CO₂ equivalents from all enterprises of 1.00 ha IFS model. The major part (57 %) of total greenhouse gas emissions was contributed by all livestock by emitting methane and nitrous oxide due to enteric fermentation and manure management system. The crop production including all agronomic cropping systems, fodder crops and kitchen garden together contributed 37 per cent of GHG emission. The plantation of forest and horticulture trees contributed negligible amount of GHG emissions (6%). The horticultural fruit crop and agro-forestry component contributed highest of the total mean carbon sink (56 %). Instead of burning all crop residues, its incorporation in soil contributed 44 per cent of the total mean sink of carbon.

Conclusions

It is concluded that, the incorporation of all crop residues and inclusion of plantation of at least four suitable agro-forestry trees on boarder of farm and horticultural fruit crop on at least 0.25 ha per ha of IFS module shown a promising option to enhance adequate negative balance of carbon, which is highly climate resilient.

Keywords: Carbon, GHG emission, IFS**Adoption of Climate smart agricultural practices in rural households of Saptari district, Nepal****Rajendra Mishra, Pramesh Raj Karnikar, Kanchanpur, Nepal****Purpose**

Climate change has affected different aspects of agriculture and in the livelihood of Saptari district. The district is among the lower human development index. Variation in temperature has affected

the agricultural practices and crops cultivation. The study observed status and assessment of methods adopted to cope against the negative impact of climate change.

Methods

A household level assessment completed within the district with sample size of 140 in two rural municipalities of Sapatri District (Agnisair Krisnhanan and Rupani Rural Municipality) with simple random sampling. The study included knowledge, climatic issues and adopted practices within the area mainly. Respondents were mostly females with low land holding area.

Results

Quantitative analysis showed that farmers have little knowledge on climate smart agriculture, practices of improved climate smart practices are less adopted and policies are not well planned in reference to new federal structure of Nepal.

Conclusions

Due to low level of knowledge and awareness, adoption of climate smart agricultural practices an effective plan is needed to develop to enhance the economic as well as nutrition status of farmers.

Keywords: Climate change, temperature, impact, knowledge

Constraints Faced By Farmers In Selected Oilseeds Crop Production In Vidarbha Region Of Maharashtra State

Sunita N. Suryawanshi¹ Asha Kayarwar² Pradnya S. Kadam³ N.T. Bagde⁴

1. & 4. Agricultural Economics, College of Agriculture,

Nagpur, Dr.PDKV,Akola ,mailid.- suryawanshisunita@gmail.com

2. Statistics (Contractual), College of Agriculture, Nagpur

3.Pulses Research Unit, Dr.PDKV,Akola.

Abstract

The present study was undertaken in Vidarbha region of Maharashtra state, as the Vidarbha region was selected purposively where the oilseeds crop area is decline in this region. Total 60 oilseed growers (soybean and groundnut) from the three districts namely, Nagpur, Wardha and Yavatmal were purposely selected from the Vidarbha region. The data collected in predesigned schedule pertained for the year 2020-21. The farmers were asked to rank the constraints faced in the order of significance. Garrett's ranking technique was used to examine the farmers' opinion. The per cent position estimated is transformed into scores by using Garrett's Table. Constraints encountered in production of soybean and groundnut crop was categorised as technological factors, agro-climatic factors and economic factors. According to the findings of the research, the major constraint of incidence of diseases and insects pests (74.73%) under technological factor, excessive rains (65.20%) in an agro-climatic factor, high input costs (73.33%) in an economic factor ranked-I in soybean production. The major constraint in production of groundnut were irregular supply of water/electricity (65.70%) under technological Factor, poor pod setting (60.77%) in an agro-climatic factor and destruction due to wild animals (150%) in an economic factor ranked-I. The technology intervention in oilseed production, extension activities, training and awareness programme for the farmers and need of the mass media were recommended from the study over the constraints faced by the farmers.

Key words- Constraints, Soybean, Groundnut, Production, Garrett's ranking.

Introduction

Oilseeds occupy a special status in Indian agricultural production and economy after cereals and [pulses](#). Attributed by high oil content along with several vitamins, minerals and fatty acids (both saturated and unsaturated), oilseeds are energy dense foods that have a vital position

in human diet. They are also used by industries for preparation of lubricants, Vanaspati, soap, detergent, cosmetics, etc. In addition to this, oilseeds are used for therapeutic applications, preparing medicines, animal feed, and [organic manure](#). With about 27 M ha area under oilseeds cultivation and production of 29 Mt, with an average yield of 1095 kg/ha, India occupies a remarkable position in the world as the fourth leading oilseeds producing country after USA, China and Brazil. Agriculture has been and will continue to be the lifeline of the Indian economy. As the largest private enterprise in India, agriculture contributes nearly about 14 per cent of the national GDP, sustains livelihood of about two thirds of population and is the backbone of agro-based industries. A large number of important industries like textiles, vanaspati oils, jute, tobacco and sugar are sustained on raw materials produced in farm sector. India is one of the largest producers of oilseeds in the world and occupies an important position in the Indian agricultural economy. The Oilseeds sector has been one of the most dynamic components of world agriculture in the past three decades growing at 4.1% per annum surpassing the growth of agriculture and livestock products.

In Maharashtra major Oilseed crops are groundnut, sunflower, soybean and minor oilseed crops is safflower which is largely grown in area. During the last few years, to domestic consumption of edible oils has increased substantially and has touched the level of 18.90 million tonnes in 2011-12 and is likely to increase further. In Vidarbha region total oilseed crop area, production and productivity was 18013.85 hundred hectare, 19802.13 hundred tonnes, and 1099.27 kg/ha, respectively during the year 2019-20. And during year 2020-21, the total oilseeds crop area, production and productivity of was, 18859.58 hundred hectare, 22,616.81 hundred tonnes and 1199.22 kg/ha, respectively. In Vidarbha region total oilseed crop area, production and productivity was 18013.85 hundred hectare, 19802.13 hundred tonnes, and 1099.27 kg/ha, respectively during the year 2019-20. And during year 200-21, the total oilseeds crop area, production and productivity of was, 18859.58 hundred hectare, 22,616.81 hundred tonnes and 1199.22 kg/ha, respectively. With intension to smooth growth of oilseed production in Vidarbha region, it is need of hour to study the various dimensions of oilseed productions.

The major crops cultivated in Vidarbha region are groundnut and soybean. Groundnut is the most important oilseed of India and accounts for a little less than half of the major oilseeds produced in the country. Groundnut kernels are rich in proteins and vitamins and have high calorific value. It contains 40-50 per cent oil which is mainly used as edible oil in its pure form or hydrogenated vanaspati form. Soybean (*Glycine max*) is important oil yielding rainy season crop having multiple uses. It stands second, among nine oilseed crops, next only to groundnut production in the country. It has outstanding nutritive value with 40-44% biological protein, 20% oil and is also very rich in vitamins, iron, mineral salts and amino acids. Soybean which is also known as soya beans are species of legume that have become one of the most widely consumed foods in the world. Therefore, as the area of oilseeds crop is declining, it is important and necessary to study constraints faced in selected oilseeds crop production in Vidarbha region. In light of this scenario, the present research was conducted with following specific objective.

- To identify the constraints that the farmers encountered in the production of major oilseed crops.

Methodology

Keeping in the view objective of the study the primary data for the year 2020-21 were collected by personal interview in predesigned schedule. Two oilseed crops i.e, groundnut and soybean were selected for the study. Survey method was adopted for selection of districts, tahsils, villages and oilseed growers. Three districts namely, Nagpur, Wardha and Yavatmal were purposely selected as area of major oilseed crops is concentrated in these districts. from each

district two tahsils were selected. From each tahsils, two villages were selected purposively. Total 60 sample of oilseed growers of selected district of Vidarbha region.

Selection of sample:

Sr. No	Name of District	Name of Tehsil & Villages	Total No. of Farmers
1	Nagpur	Saoner-	
		1) Bhendala	05
		2) Wakodi	05
		Umrer -	
1) Makardhokada	05		
	2) Dhurkheda	05	
2	Wardha	Selu-	
		1) Kelzer,	05
		2) Hingni	05
		Deoli	
1) Deoli	05		
2) Takli	05		
3	Yavatmal	Yavatmal	
		1) Kapara	05
		2) Yelabara	05
		Kalmab	
1) Sarap Dhari	05		
2) Rasa	05		
	TOTAL		60

The constraints in oilseed crops production faced by the oilseed growers were analyzed by using Garrett's ranking technique. To identify the most important factor influencing the production, Garrett's ranking technique was applied. The ranks given by each oilseed grower were converted into per cent position by using formula:

$$\text{Per cent position} = 100 (R_{ij} - 0.50) / N_j$$

Where, R_{ij} = Rank given to i^{th} constraint by the j^{th} individual and N_j = Number of constraints ranked by the j^{th} individual.

The per cent position of each rank will be converted into scores referring to the table given by Garrett and Woodworth (1969). factors, the scores of individual respondents will be added together and divided by the total number of the respondents for whom scores will be added. These mean scores for all the constraints will be arranged in descending order; the constraints will be accordingly ranked.

Results and Discussion

Constraints encountered by the growers in production of soybean in Vidarbha region is presented in Table 1.

Table 1. Garrett's ranks and scores on Constraints encountered by growers in production of soybean in Vidarbha Region

Sr.no	Constraints in production of soybean	Total mean (Score)	Garrett Rank
	Technological Factors		

1	Non-availability of suitable varieties	51.60	III
2	Lack of awareness of improved oilseeds technologies	50.66	IV
3	Poor crop germination	57.13	II
4	Lack of irrigation facilities	31.63	V
5	Incidence of diseases and insect pests	74.73	I
6	Irregular supply of water/electricity	31.23	VI
Agro-climatic Factors			
1	Drought at critical stages of crop growth	37.96	III
2	Excessive rains	65.20	I
3	Poor pod/grain setting	46.83	II
Economic Factors			
1	High input costs (Seed, diesel, fertilizers, agrochemicals)	73.33	I
2	Shortage of human labour	49.66	II
3	Low and fluctuating prices	47.66	IV
4	Oilseeds less profitable compared with other crops	49.33	III
5	Destruction due to wild animals	30.00	V

The result of the study indicated from Table 1, that the most important technological constraints in the production of soybean was incidence of disease and insect pest ranked Ist with the total mean score I (74.73%) and poor crop germination ranked II (57.13%). It is followed by non-availability of suitable varieties (51.6%), lack of awareness of improved oilseeds technologies (50.66%), lack of irrigation facilities (31.63%) and irregular supply of water /electricity (31.23%) ranked III, IV, V, VI, respectively. As regards to the agro-climatic factors constraints excessive rains ranked I (65.20%) and poor pod setting ranked II (46.83%) which is followed by drought at critical stages of crop growth (37.96%) ranked II position.

Among the economic factors constraints High input cost (Seed, Diesel, fertilizers, agrochemical) Ranked I (73.33%) and shortage of human labor ranked II (49.66%), oilseed less profitable as compared with other crops ranked III (49.33%), low and fluctuating prices ranked IV (47.66%) and destruction due to wild animals ranked IV, respectively. This finding collaborates with Kwaghe et al. (2000) who reported high cost of important farm inputs militating against efficient farming. It also agreed with the findings of Tashkalma et al. (2010) Zalkuwi (2012).

Constraints encountered by the growers in production of groundnut in Vidarbha region is presented in Table 2.

Table.2 Garrett's ranks and scores on Constraints encountered by growers in production of groundnut in Vidarbha Region

Sr.no	Constraints in production of groundnut	Total mean (Score)	Garrett Rank
Technological Factors			

1	Non-availability of suitable varieties	50.00	II
2	Lack of awareness of improved oilseeds technologies	48.53	III
3	Poor crop germination	46.00	IV
4	Lack of irrigation facilities	43.53	VI
5	Incidence of diseases and insects pests	45.97	V
6	Irregular supply of water/electricity	65.70	I
Agro-climatic Factors			
1	Drought at critical stages of crop growth	53.17	II
2	Excessive rains	36.07	III
3	Poor pod setting	60.77	I
Economic Factors			
1	High input costs (Seed, diesel, fertilizers, agrochemicals)	57.17	III
2	Shortage of human labour	57.33	II
3	Low and fluctuating prices	51.33	IV
4	Oilseeds less profitable compared with other crops	36.50	V
5	Destruction due to wild animals	150.00	I

Multiple response taken to ascertain the constraints faced by oilseeds growers in the production of groundnut opinion of the selected oilseed growers were taken in order to understand the problems in the production of groundnut.

Garrett ranking technique was employed to find out the constraints faced by the oilseed growers in production of groundnut were explained in terms of rank and total mean (score) presented in the table 12. The results influence the most important technological factors constraints in the production of groundnut crop which rank first was irregular supply of water/Electricity with the total mean score (65.70%) followed by non-availability of suitable varieties and lack of awareness of improves oilseeds technologies which ranked II and III with the total mean score 50% and 48.53%. As regards to the agro-climatic factors , poor pod setting ranked I (60.77%) , drought at critical stages of crop growth ranked II and excessive rains (36.07) rank III.

In economic factors destruction due to wild animals rank I with highest percentage (150.00) among all the factors and shortage of human labour rank II (57.33%) and high input costs (Seeds, diesel, fertilizers, agrochemicals) ranked III(57.17%). The findings of the present study are in line with Jagriti et al. (2017), who reported high cost of fertilizers and manures (54.23) as an economic constraint faced by the farmers . Low and fluctuating prices ranked IV(51.33 %) and oilseeds less profitable compared with other crops ranked V (36.50%).

Conclusions

The most important technological constraints in the production of soybean were incidence of disease and insect pest ranked Ist with the total mean score I (74.73%) and poor crop germination ranked II (57.13%). Agro-climatic factors constraints excessive rains ranked I (65.20%) and poor pod setting ranked II (46.83%). In economic factors high input costs (seed, diesel, fertilizers, agrochemicals) rank I with highest percentage (73.33) among all the factors and shortage of human labour rank II (49.66%) The most important technological factors constraints in the production of groundnut crop which rank first was irregular supply of water/Electricity with the total mean score (65.70%) followed by non-availability of suitable varieties and lack of awareness of improves oilseeds technologies which ranked II and III with the total mean score 50% and 48.53%. In agro-climatic factors, poor pod setting ranked I (60.77%). Economic factors destruction due to wild animals rank I with highest percentage (150.00) among all the factors and shortage of human labour rank II (57.33%). So it is the high time to support the oilseed growers through the research and development, long term planning, government policies coupled with remunerative pricing of the produce to take country towards self-sufficiency.

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A dual purpose, high yielding Little millet (*Panicum sumatrense*) variety 'GV-4' (Ambika) for cultivation in Gujarat.

Patil, H. E.¹; Vavdiya, P.A.²; Vadodariya, G.D.³ and Patel, B.K.⁴

²College of Agriculture, NAU, Waghai (Dangs), Gujarat, India- 394 730.

Purpose

Little millet (*Panicum sumatrense*) is an important millet crop having high nutritional values as it is good source of protein, very rich in carbohydrate, fat, mineral and vitamins and should be considered as essential food for nutritional security. As little millet being neglectable crop, very few varieties are there having high yield and high nutrient content. The aim of this research is to develop high yielding and nutri-rich little millet variety from the local germplasm collections.

Methods

Single plant with desirable traits and high yield with medium maturing and resistant to diseases like Blast (Leaf, Neck and Panicle) and moderately resistant to grain smut and sheath blight was selected from the germplasm accession and was forwarded as single plant to progeny rows. The promising culture was evaluated over seven years at Waghai location with checks including multi-location trails at Waghai, Vanarasi and Dahod starting from 2017-18 to 2020-21 and also tested in All India Co-ordinated trials under AICRP-Small millets in 5 states across 8 locations from 2016-17 to 2018-19. The reaction of the cultures against important pest and disease was also screened and as per the standard procedures the grain qualities were analyzed.

Results

The little millet variety 'GV-4' (Ambika) is a pure line selection from the local germplasm collected from the Dang District. A little millet variety 'GV-4' was tested as a genotype name 'WV-126'. The genotype 'WV 126' tested under the various state trials found to be superior for grain yield (2933 kg/ha) by 21.20, 13.78, 44.39 and 31.44 % over the existing checks *i.e.* GV-2 (LC), GNV-3 (LC), CO-2 (NC) and OLM-203 (NC), respectively over thirteen trials and seven years (2014-15 to 2020-21) of study. The genotype matures in 120-125 days includes under medium duration variety. The genotype WV-126 has 9-10 branches per panicle and 35.5 cm average panicle length. This genotype has special attributes of synchronized maturity and non-lodging growth habit. The genotype WV-126 is rich in calcium (17.1 mg/100g), protein (12.91 g/100g), fat (3.3 %), crude fiber (7.5 %), carbohydrates (70.40 g/100g) and minerals (2.7 g/100g). This genotype is resistant to diseases like blast (leaf, neck and panicle) and moderately resistant to grain smut and sheath blight when compared to local check GV-2 and GV-3 and national check CO-2, OLM-203 and JK-8.

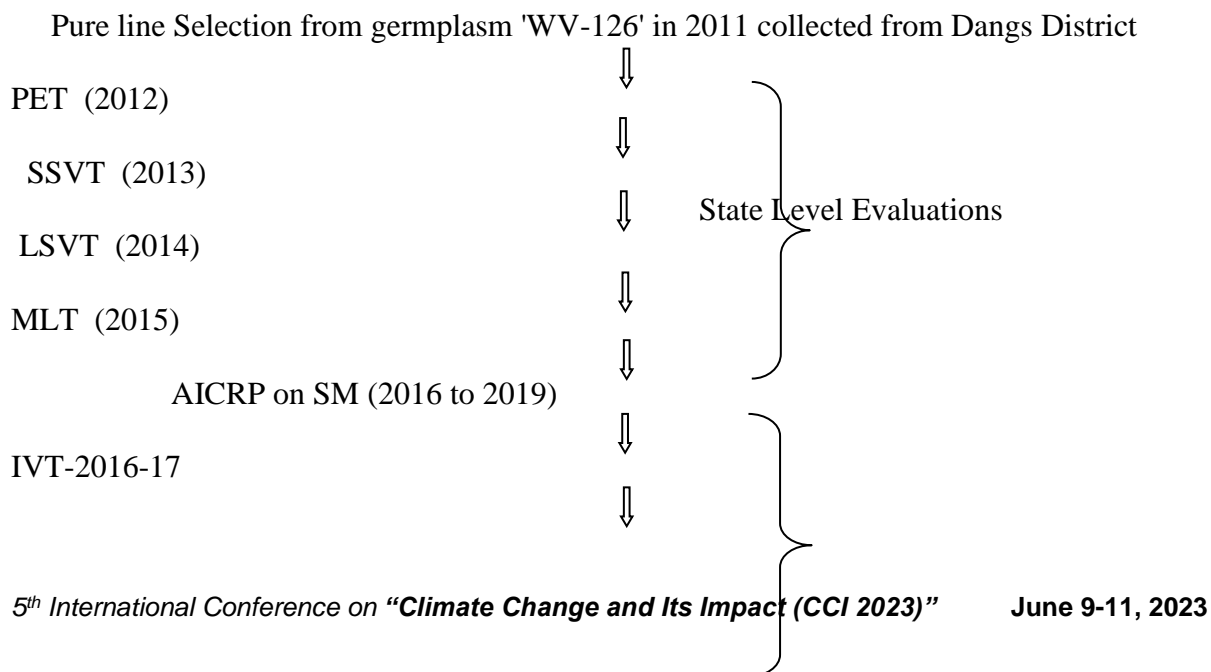
Conclusions

Considering the superior performance of the little millet culture 'WV-126' over the local check varieties namely GV-2 and GNV-3 as well as national check variety CO-2 and OLM-203, the WV-126 was released as a new variety GV-4 (Gujarat Vari-4/ Ambika) for large scale cultivation in Gujarat during 2021.

Key words:

Little millet, high yielding variety, yield attributing characters, nutritional quality etc.

Pedigree chart of Little millet variety GV-4 developed from genotype 'WV 126'



AVT-I-2017-18

AICRP-SM Level Evaluations

AVT-II-2018-19

Agronomy Trial 2019-20

Proposed for Variety Release (2020-2021)

Ecological and Economic Potential of Amla (*Phyllanthus emblica* L.): A Horticulture Crop for Degraded Land Restoration, Food Security and Sustainable Livelihood in Chhattisgarh, India**Abhishek Maitry, Gunjan Patil*, Preety Shah, Gunja Baretha, Damini Sharma and Ramesh**
*Department of Forestry, Wildlife & Environmental Sciences, Guru Ghasidas Vishwavidyalaya, Bilaspur, Chhattisgarh- 495009, India***Purpose**

The tree *Phyllanthus emblica* L., generally known as Amla, is an indigenous tree to Southeast Asia and India. Being one of the most well-known botanicals, *Phyllanthus emblica* L.'s fruit has a variety of applications in the culinary, cosmetic, and pharmaceutical industries, and is also a good source of raw food. Amla can also be seen as an important native horticultural crop species for the restoration of degraded lands and it also provides various ecosystem services. The demand for Amla is rising in both local and foreign markets as a result of rising health consciousness among people. Objective of the current study deals with the identification of economical as well as ecological benefits of Amla tree.

Methodology

The study involved the gathering of data from both primary and secondary sources as well as field work which includes the identification of medicinal importance and active constituents of Amla and its traditional uses in central India. The production status of Amla in Chhattisgarh state for the last five years was evaluated along with a total area of production to study recent trends. Diversity assessment was also carried out in few restoration sites to identify the importance of Amla trees in degraded lands. Along with that, economic valuation was done to identify its potential in Chhattisgarh state. SWOT analysis was also performed to understand the strengths, weaknesses, opportunities and threats regarding the production and utilization of Amla.

Results

It contains several chemical constituents and almost all parts possess medicinal properties, particularly fruit which have various aspects of the application for humans. Chhattisgarh holds the 5th position with about 4-5% of the total production value. An increment in the production quantity of Amla crop was seen in recent years from 43289 MT in 2017-18 to 45824 MT in 2022-23. Also, Amla after 6 years of cultivation and Rs. 15,000 of input cost can give up to Rs. 50,000 as output from 10 tonne fruit production. Amla has also been found in one of the important native horticultural crops in degraded areas across Chhattisgarh. Beside common uses, Amla also provides various ecosystem services. Based on SWOT analysis, a strong relationship with the rural community and adoption in degraded lands are the strengths with opportunities like acceptance of Amla for processing and utilization increasing the demand. Weakness includes the unavailability of proper processing units near the production area with poor government policy for import and export as a major threat.

Conclusion

Based on the current study, Amla can be seen as an important native horticultural crop species for the restoration of degraded lands and it also provides various ecosystem services. It also has an important role in traditional medicine and is a good source of food for both humans and animals. A few points are to be considered to increase the potential of Amla which include the development of proper marketing channels with the establishment of more processing units near the production area and motivating people to plant the species, aware them for sustainable management and also give emphasis on research part to increase the quantity and sufficient production with less time to fulfil the demand of Amla as well as to develop a knowledge about the secondary benefits of Amla crop is necessary to identify its ecological importance and increase the production by plantation of same in degraded lands.

Keywords: Amla, Horticulture, Food Security, Restoration, Sustainability

Long-Term Integrated Nutrient Management enhanced nutrient concentration and yield in rice-wheat system

Hena Parveen, Sunil Kumar, Sheriya sen, Ayesha Fatima

Dr. Kalam Agricultural College, Kishanganj, Bihar Agricultural university, Sabour, Bhagalpur

Purpose

The present epoch of intensive high-yield agriculture is much dependent on inorganic fertilizers. The farming amplification over the last few decades has strongly increased global food production, but at high ecological cost (Conway 1997; Tilman et al. 2001), At the same time, every effort should be made to improve the availability and use of secondary nutrients and micronutrients, organic fertilizers, and soil conservation practices to augment crop yield and quality in an efficient without sacrificing soil health.

Methods

Integrated nutrient management (INM) involving chemical fertilizers and organic amendments viz. FYM, wheat straw and Sesbania was applied 3 weeks before rice transplanting as per treatment to substitute a specified amount of N. Twelve treatments were control (T1) (Contro); 50% RDF to both rice and wheat (T2); 50% RDF to rice and 100% RDF to wheat (T3); 75% RDF to both rice and wheat (T4); 100% RDF to both rice and wheat (T5); 50% RDF + 50% N through (FYM) to rice and 100% RDF to wheat (T6); 75% RDF + 25% N through FYM to rice and 75% RDF to wheat (T7); 50% RDF + 50% N through WS to rice and 100% RDF to wheat (T8); 75% RDF + 25% N through WS to rice and 75% RDF to wheat (T9); 50% RDF + 50% N through (GLM) to rice and 100% RDF to wheat (T10); 75% RDF + 25% N through (GLM) to rice and 75% RDF to wheat (T11); farmer's fertilizers practice to rice and wheat (70 kg N + 13.2 kg P + 8.3 kg K/ha)(T12).

Results

Results revealed that continuous use of chemical fertilizers along with organic amendments in rice-wheat cropping system (RWCS) for 34 years has resulted to an improved the yield of rice and residual effect in wheat crop also increased with T₆ due to different INM treatments. FYM, GM

and W.S are important and renewable organic sources of nutrients. Nutrient concentration in both crops were found significantly superior within the treatments receiving supplemented N through FYM, WS and GM viz., T₆ T₇, T₈, T₉ and T₁₀ as compare to T₅-100 RDF of NPK applied.

Conclusions

Application of FYM, WS and GM might have added enormous quantity of organic matter in soil and thus produced augmented yield, nutrient concentration and uptake of rice and wheat crop.

Keywords: organic matter, integrated nutrient management, global food, secondary nutrients

Repellent To Monkeys, Wild & Stray Animals

Ajit Singh Chandele, Suraj Mehrotra, Sharad Patil, Amrut Kalokhe, Avinash Salunke

Pestosys LLP, Pune, Pin 411015 MS (Start-up company under RKVY RAFTAR incubation at MANAGE)

Purpose

Green Technology approach for sustainability

With the rising issue of human-animal conflict due to habitat destruction and urbanisation, it has become crucial to devise effective strategies to deter monkeys, wild, and stray animals. This project focuses on developing animal repellents as tools to keep these animals away, using natural and non-invasive methods.

Objectives:

To identify and develop effective animal repellents for monkeys, wild, and stray animals.

To assess the behavioural responses of target animals to these repellents.

To ensure the eco-friendliness and non-invasiveness of the developed repellents.

To contribute to the reduction of human-animal conflict in urban and rural settings.

Methodology:

Conducting a literature review to identify potential natural repellents and their effectiveness.

Field studies to observe the behavior of target animals in the presence of repellents.

Development and testing of prototypes for effectiveness, safety, and environmental impact.

Implementation of successful repellents in pilot locations.

Results:

Identification of several natural repellents, such as essential oils, predator urine, and plant extracts.

Observed reduction in conflict and avoidance behavior in target animals exposed to repellents. Successful development of eco-friendly and non-invasive prototypes, including scent-based deterrents and visual devices. Positive feedback from pilot locations, reporting reduced human-animal conflict and minimal ecological impact.

Conclusion:

This project successfully demonstrated the potential of using animal repellents as tools to keep monkeys, wild, and stray animals away. By employing natural and non-invasive methods, the developed repellents showed promising results in reducing human-animal conflict across various settings. These strategies contribute to sustainable and harmonious coexistence between humans and animals, while minimising any negative environmental consequences.

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Vertebrate Pest Management By Male Contraceptive

Ajit Singh Chandele, Suraj Mehrotra, Sharad Patil, Amrut Kalokhe, Avinash Salunke

Pestosys LLP, Pune, Pin 411015 MS (Start-up company under RKVY RAFTAR incubation at MANAGE)

Purpose

Vertebrate Pest Management for Sustainable Agriculture

Vertebrate pest management has been a significant concern for wildlife and agricultural management authorities. Uncontrolled populations of vertebrate pests, including monkeys, pigs, rodents, bears, and langurs, can lead to severe ecological and economic consequences. Gossypol, a naturally occurring compound in cotton plants, has shown potential as a male contraceptive, providing a promising solution for controlling these pest populations.

Objectives

To evaluate the effectiveness of Gossypol as a male contraceptive for various vertebrate pests.

To determine the optimal dosage and administration method for Gossypol.

To assess the potential ecological and economic benefits of using Gossypol for vertebrate pest management.

Methodology

Conduct a comprehensive literature review on Gossypol's contraceptive effects on different vertebrate species.

Perform controlled lab experiments to determine the optimal dosage and administration method of Gossypol for targeted species.

Monitor Gossypol's effectiveness in controlling pest populations in selected field sites.

Analyse the data to evaluate the ecological and economic benefits of using Gossypol for vertebrate pest management.

Results

The study revealed that Gossypol effectively reduced fertility in monkeys, pigs, rodents, bears, and langurs when administered in appropriate dosages. It was found that the optimal dosage and administration method varied among species. Gossypol demonstrated promising results in controlling the population growth of these vertebrate pests. Consequently, this led to reduced ecological damage and economic losses caused by their overpopulation.

Conclusion

Gossypol, as a male contraceptive, offers a practical and eco-friendly solution for managing vertebrate pest populations. The appropriate use of Gossypol can lead to significant ecological and economic benefits, effectively mitigating the negative impacts of overpopulation of these species.

References

Gossypol: a potential antifertility agent for males

S Z Qian, Z G Wang

PMID: 6375548 DOI: 10.1146/annurev.pa.24.040184.001553

Reversible antispermatogenic effect of gossypol in langur monkeys (*Presbytis entellus entellus*)

S Sharma 1, M Kumar, R B Goyal, B Manivannan, N K Lohiya

Affiliations expand

PMID: 10794043 DOI: 10.1023/a:1006627410734

Gossypol: a male contraceptive with potential?

I D Morris

PMID: 12280996

Gossypol: a contraceptive for men

Elsimar Metzker Coutinho 1

Affiliations expand

PMID: 12020773 DOI: 10.1016/s0010-7824(02)00294-9

Predator Urine Repellent In Wildlife Management

Ajit Singh Chandele, Suraj Mehrotra, Sharad Patil, Amrut Kalokhe, Avinash Salunke

Pestosys LLP, Pune, Pin 411015 MS (Start-up company under RKVY RAFTAR incubation at MANAGE)

Purpose

Natural Resource Management their Conservation & Sustainable Utilization of Natural Resources
The use of predator urine as a wildlife repellent has emerged as a promising, eco-friendly, and non-lethal solution for managing the populations of various wild animals, including deer, monkeys, bears, langurs, elephants, and pigs. The fear of predators has been a key factor in shaping the behaviour of prey animals, and utilizing predator urine, such as tiger urine, can help maintain a balanced ecosystem and reduce human-wildlife conflicts.

Objectives:

The main objective of this project is to evaluate the effectiveness of predator (tiger) urine as a repellent for deer, monkeys, bears, langurs, elephants, and pigs. The study aims to:

Understand the behavioral response of target species to the presence of predator urine.

Assess the duration and efficacy of predator urine as a repellent.

Develop a practical and cost-effective method for applying predator urine in various habitats.

Methodology:

Field experiments will be conducted in areas with a high population of target species. Tiger urine will be collected from captive animals, and the chemical composition will be analyzed to ensure its effectiveness. Various concentrations and application methods will be tested, including spray, pellets, and slow-release devices.

Results:

The results are expected to demonstrate the effectiveness of tiger urine as a repellent for deer, monkeys, bears, langurs, elephants, and pigs. The study should reveal the most effective concentration and application method, as well as the duration of the repellent effect.

Conclusion:

The use of predator urine, specifically tiger urine, has the potential to become an effective, eco-friendly, and non-lethal wildlife management tool. Implementing this method can help maintain a balanced ecosystem, reduce human-wildlife conflicts, and protect both wildlife and human populations.

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M.K. Chowdhury (1) And I Roy (2) Some Observations on the use of Tiger Scent (Urine & Tiger Calls as Repellents to Elephants) 1 Conservator of Forests, Wild Life Circle, West Bengal. Divisional Forest Officer, Wild Life Division-I, West Bengal.

Vermin Rodent, Monkey Control By Sterilants

Ajit Singh Chandele, Suraj Mehrotra, Sharad Patil, Amrut Kalokhe, Avinash Salunke

Pestosys LLP, Pune, Pin 411015 MS (Start-up company under RKVY RAFTAR incubation at MANAGE)

Purpose

Reproductive & Biological Tool For Vermin

The increasing conflict between wildlife and human populations poses a significant challenge to wildlife conservation efforts and the well-being of local communities. This project aims to explore the potential of sterilant, such as Alfa chlorohydrin, gossypol, and other natural methods, as a means of controlling wildlife over-populations, including rodents, monkeys, pigs, bears, deer, langurs, and insect pests.

Objectives

Investigate the effectiveness of sterilant, including Alfa chlorohydrin and gossypol, in managing wildlife over-populations.

Assess the potential impact of these sterilant on target species and their ecosystems.

Develop guidelines for the safe and effective use of sterilant in over-populated areas for wildlife management.

Methodology

A thorough review of existing literature on sterilant and their effectiveness in controlling various wildlife over-populations.

Field trials to evaluate the impact of sterilant on target species, including population size and reproductive rates.

Monitoring and assessment of potential side effects on non-target species and ecosystems.

Development of best practice guidelines for the application of sterilant in wildlife management.

Results

Sterilants such as Alfa chlorohydrin and gossypol have shown promise in controlling rodent populations and reducing the reproductive rates of target species.

These sterilant have also demonstrated potential for managing populations of monkeys, pigs, bears, deer, and langurs, with varying degrees of success.

Although some side effects have been observed, these are generally limited and can be mitigated through careful planning and management.

The development of best practice guidelines will ensure that sterilant are applied safely and effectively to minimize any potential negative impacts on non-target species and ecosystems.

Conclusion

Sterilants such as Alfa chlorohydrin, gossypol, and other natural methods offer a promising solution for the management of various wildlife populations. With careful planning and adherence to best practice guidelines, these sterilant can provide an effective and sustainable means of controlling wildlife populations and reducing human-wildlife conflicts.

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Standardization of fertigation schedules on plant growth and yield of Red Cabbage under Telangana condition

A. Mamatha¹ and A.V.N. Lavanya², D. Anitha Kumari² and V. Suresh²

¹*Dept. of Vegetable Science, College of Horticulture, Sri Konda Laxman Telangana State Horticultural University, Rajendranagar, Hyderabad, Telangana – 500030.*

²*Vegetable Research Station, Sri Konda Laxman Telangana State Horticultural University, Rajendranagar, Telangana, Hyderabad, Telangana – 500030.*

Purpose:

Red cabbage (*Brassica oleracea* var. *capitata* f. *rubra*) is one of the important member of the family Cruciferae, is a nutritious and delicious vegetable that has become very popular throughout the world because of its rich content of minerals (calcium, manganese, magnesium, iron and potassium), vitamins C, A, E and K, and dietary fiber. It is consumed fresh as a salad or cooked, or can be used after processing.

Precise management of irrigation quantity along with the rate and timing of nutrient application are of critical importance to obtain desired results in terms of productivity and Fertilizer use efficiency (FUE). Fertigation facilitates the enhanced mobility, availability and uptake of applied nutrients because of higher soil moisture content (Silber, 2008) and more frequent application of fertilizers, corresponding to quantitative and timely demand by the crops (Srivastava, 2005). Hence, the present investigation is aimed to standardize the appropriate fertigation schedule to the farmers of our state.

Methods:

The present experiment were conducted to study the influence of different fertigation levels on growth and yield of RedCabbage during (*Rabi* 2019-20, 2020-21 & 2021-22) in randomized block design with four replications and five treatments *viz.* T1 -60% RDF (120-75-90 NPK kg ha⁻¹), T2 -80% (160-100-120 NPK kg ha⁻¹) RDF, T3 -100% RDF (200:125:150 NPK kg ha⁻¹), T4 -120% RDF (240-150-180 NPK kg ha⁻¹) & T5 –control at Vegetable Research Station, SKLTSHU, Rajendranagar, Hyderabad, Telangana, India. Fertigation was scheduled at 5 days interval in 20 splits using water soluble fertilizers like Urea (260 kg/ha), 12-61-0 -MAP (40 kg/ha) & 13-0-46 - K Nitrate KNO₃ (265 kg/ha) through surface drip irrigation. 75% P applied as basal through SSP (470 kg/ha) and remaining 25 % by using above water soluble fertilizers.

Periodical observations were recorded on growth and yield parameters. Five plants were randomly selected and tagged at vegetative stage from each treatment to record the data on the following attributes. The observations were recorded on plant height (cm), number of leaves per plant, plant spread at Harvest (cm) –E-W & N-S, Head yield/ plant(g), Head yield/ha. (t) and B:C ratio. Least significant difference at 5% level was used for finding the significant differences among the treatment means. Data on growth and yield components were collected using standard procedures and were analyzed statistically by online Statistical Analysis Tool given by Sheoran O.P *et al*, 2020. The Benefit: Cost (B:C) ratio was calculated by dividing the net returns by the cost of cultivation.

Results:

The three years pooled data from 2019-22, revealed that, among 5 treatments maximum yield per ha was recorded in the treatment F 2 i.e. 80 % RDF (36.66 t/ha) is on par with the treatment F 3 i.e. 100 % RDF (33.68 t/ha). However, the highest B:C ratio (1:3.92) was observed in the treatment F 2 i.e. 80 % RDF (160:100:120 kg NPK/ha) through drip irrigation by using fertilizers like Urea (260 kg/ha), 75% P applied as basal through SSP (470 kg/ha), water soluble fertilizers MAP (12-61-0) (40 kg/ha) and K-Nitrate (13-0-45) (265 kg/ha) in 20 splits at 5 days interval. Fertigation with 80 % RDF is recorded superior yields (33.68 t/ha) with highest B:C ratio of (1:3.92).

Conclusions:

Fertigation provides a variety of benefits to the users like high crop productivity and quality, resource use efficiency, environmental safety, flexibility in field operations, effective weed management and successful crop cultivation on fields with undulating topography. Fertigation is considered eco-friendly as it avoids the leaching of nutrients. Fertigation through drip irrigation can yield a fertilizer savings in the range of 25 to 50 per cent. Therefore, it is possible to dispense adequate nutrient quantity at an appropriate concentration to meet the crop demand during a growing season. From this experiment, it is concluded that application of 80 % RDF (160:100:120 kg NPK/ha) through drip irrigation in 20 splits at 5 days interval recorded superior yields (33.68 t/ha) with highest B:C ratio of (1:3.92).

Keywords: Red cabbage, fertigation, head yield, Fertilizer Use efficiency.

Flood Vulnerability of Rural Women – An Indicator-based Approach

Holy Mercy Divina Matla¹, Pratheesh Pradeep Gopinath², Allan Thomas¹, Archana Raghavan Sathyan^{1,3}

¹Department of Agricultural Extension, College of Agriculture, Kerala Agricultural University, Thiruvananthapuram 695522 Kerala, India

²Department of Agricultural Statistics, Kerala Agricultural University, Thiruvananthapuram-695522, India

³Centre for International Development and Environmental Research (ZEU), Justus Liebig University Giessen, Senckenbergstrasse 3, 35390 Gießen, Germany

Purpose

In Kerala, floods are regarded as a serious and common danger, impacting 14.8% of the region and 52% of the population who are at risk from their effects. In terms of these obstacles' effects, vulnerabilities, and capacities for adaptation, men and women exhibit significant disparities. Due to restrictive gender norms and a significant reliance on agriculture, rural women are particularly heavily struck by flood effects.

Methods

The study's objective is to evaluate the flood vulnerability of rural women (FVI^{RW}) for the chosen AEU in Kerala utilising the three aspects of vulnerability—adaptive capacity, sensitivity, and exposure—under which 9 key components and 69 indicators were chosen. The study, which was carried out in Pokkali Land and Kuttanadu AEU, was founded on primary information gathered through in-person interviews with 200 rural women.

Results

According to the calculated FVI^{RW} value, rural women in Pokkali (0.562) and Kuttanad (0.551) are both extremely susceptible. Investigating the dimensional values revealed that Pokkali had the highest exposure index value (0.679), the second-highest sensitivity dimension (0.671), and the third-highest adaptive capacity (0.471). The exposure dimension got the highest value in the case

of Kuttanadu (0.687), followed by the sensitivity (0.640) and adaptive capacity (0.464) dimensions. In-depth examination of factors such as sociodemographic profile, means of subsistence, socioeconomic resources, water, health, and food revealed the necessity for immediate policy actions.

Conclusion

Therefore, interventions such as programmes to increase women's credit borrowing capacity, linking women's organizations to credit cooperative institutions, conducting trainings on managing flood risk and embracing technology, and insurance on asset loss can be implemented to improve the current situation. With appropriate modifications, the FVI^{RW} created can also be applied to other well-known Kerala flood-prone areas and other such areas.

Keywords: Climate change, Floods, Vulnerability, Rural women, Interventions.

Effect of Ethyl Methyl Sulfonate (EMS) mutagen on seeds of china aster (*Callistephus chinensis*)

Shruti Mallikarjun Kolar and R. Vasantha kumari

Department of Horticulture, University of Agricultural Sciences, GKVK, Bangalore (Karnataka) 560065

Purpose

China aster (*Callistephus chinensis*) is a member of the asteraceae family which is an annual and self-pollinated plant. Since genetic diversity is the basis of plant breeding programs, it is important to create genetic mutations in order to increase diversity.

Methods

The investigation entitled with 'Effect of Ethyl Methyl Sulfonate (EMS) mutagen on seeds of China aster (*Callistephus chinensis*)' was carried out at floriculture unit, Department of Horticulture, University of Agriculture Sciences, GKVK, Bangalore, Karnataka during the year 2021-22. To induce mutation, seeds of china aster were treated with different concentration (0.1, 0.2, 0.3, 0.4 and 0.5%) of ethyl methyl sulfonate (EMS) for four hours. The treated seeds were sown in the raised nursery beds in research greenhouse.

Results

The results showed that different EMS concentrations had significant effect on all the studied characteristics. Mutants induced by EMS differed in various phenotypic traits, including plant height, number of branches, leaf characteristics, early flowering, flower colour, flower diameter, flower stalk length and yield in plants of the M2 generation. The lowest values of the studied traits were observed in the control except germination percentage. The highest values of most morpho-physiological traits were obtained in 0.3 % of EMS.

Conclusions

The mutants obtained in this study provide valuable germplasm resources for use in china aster crop improvement programs.

Keywords: *Callistephus chinensis*, EMS, mutant, growth, yield

Impact of Climate change on Insect pests, disease and their management

K. Venkatkiran Reddy¹, P. Dhanraj², Mohd Danish³ T. Bharath Teja⁴

P Agronomy, PJTSAU, Ph.D Agricultural extension, SHUATS, Mohd Danish, Agriculture Entomology, Assistant professor, RARS Madhira, PJTSAU

Introduction

Global climate change is a problem that affects ecosystems all around the world and has a big impact on how much food can be produced. It is anticipated that variations in temperature, precipitation, and other climatic factors will have an impact on insect pests and illnesses, which might have a significant impact on agricultural output and food security. This study article will look at how illnesses and insect pests are affected by climate change, how they are managed, and any potential effects on agricultural output.

Impact of Climate change on Insect pests:-

On insect pests, climate change is predicted to have a considerable effect. Growing insect populations could result in more agricultural loss as a result of changing precipitation patterns and rising temperatures. Climate change is anticipated to have a significant impact on insect pests, including aphids, mites, and thrips. These pests may reproduce swiftly and have short generation times, which enable them to quickly adjust to shifting environmental circumstances.

The distribution and range of insect pests can also be impacted by changes in precipitation and temperature. Due to shifting climatic circumstances, pests that were once restricted to a certain area may now spread out and enter new places. This may cause new pest issues to appear in previously unaffected areas.

The timing of pest outbreaks can also be impacted by climate change. Longer growing seasons and earlier pest activity may lead to more pest generations per year as a result of warmer temperatures. More serious insect outbreaks could follow from this, which could have a big impact on crop yields.

Impact of Climate change on Insect disease:-

Plant diseases are predicted to be impacted by climate change. The survival and growth of pathogens can be impacted by changes in temperature and humidity, which may modify the incidence and severity of disease. Plant diseases may flourish and spread if temperatures continue to rise and precipitation patterns change.

The emergence of new plant diseases is also a concern. As climate conditions change, new plant diseases could emerge, which could have significant implications for crop yields and food security. Plant diseases such as downy mildew, powdery mildew, and leaf spot are expected to be particularly affected by climate change.

Climate change can also affect the interactions between plants and pathogens. Changes in temperature and precipitation can affect plant physiology, making them more susceptible to disease. Changes in plant phenology, such as earlier flowering or fruiting, can also affect the timing of pathogen infections.

Management of Insect Pests and Diseases in the Face of Climate Change

The management of insect pests and diseases is likely to become more challenging as climate conditions change. Traditional management strategies may become less effective as pests and diseases adapt to changing climatic conditions. Integrated Pest Management (IPM) is a holistic approach to pest management that relies on a combination of tactics, including cultural, biological, and chemical control measures. IPM can help reduce the reliance on chemical pesticides, which can have negative environmental impacts.

In the face of climate change, IPM strategies will need to be adapted to account for changes in pest and disease pressure. This may involve the use of new control measures, such as the use of resistant

varieties or biological control agents. New monitoring and surveillance systems may also be required to detect and respond to new pest and disease outbreaks.

Conclusion

Climate change is expected to have a significant impact on insect pests, diseases, and their management. Changes in temperature and precipitation patterns are likely to create new challenges for agricultural production. The emergence of new pest and disease problems could have serious implications for crop yields and food security. To mitigate these impacts, it is important to develop new management strategies that are adaptive to changing climatic conditions. Integrated Pest Management is a promising approach that can help reduce the reliance on chemical pesticides and promote sustainable agriculture in the face of climate change.

Keywords: Climate change, IPM, Management, Insect, Pests and Diseases

Genetic studies on root architecture of rice for superior water relation plasticity

Jenny P. Ekka¹, Krishna Prasad^{1*}, Anita pande², Manigopa chawkraborty¹ and Priyanka Kumari¹

¹ Department of Genetics And Plant Breeding, ²College of Biotechnology, Birsa Agricultural University Kanke Jharkhand

Abstract

The global life source namely rice is a highly water dependent crop, throughout its growth cycle it is effected by various abiotic and biotic stresses. Abiotic stress especially drought or unavailability of water to the plants is one of the most important constrain to good yielding capability of rice. Drastic climate changes and increased water scarcity keeps on challenging the global food security, which is further escalated due to the need to feed a growing global population. The Resistance or tolerance to drought condition in crop plants is the result obtained from the combined effect of the interaction between different morphological and physiological characters in which high diversity of root morphological traits is known to play an very important role that is enhanced in response to drought conditions. The architecture and morphological plasticity of a root system under any environmental conditions are considered to be key traits driving the adaptive response of plants and expecting a direct impact on maintenance of grain yield. Evaluation of root architecture may allow the selection of ideal root systems for different environments, with better nutrient uptake capacity, which would allow higher yield levels even under adverse weather conditions.

Objective

To identify genotype(s) having higher yield

To estimate the character association between root traits and yield

To identify genotype(s) (segregants) having superior root architecture using molecular markers

Methodology

The present study was taken up to study the root architecture in the F₂ population obtained from a cross between IR 36 x BVD 111, the experiment was carried out in the rice research field of Brisa Agricultural University, Kanke, Jharkhand under the Department of Genetics and Plant Breeding in the Kharif Season of 2021-22 under rainfed condition. On the existing genetic variability of the segregating population and phenotypically superior plants were utilized for the study from the

segregating population, and their roots were obtained by Root Pulling technique and were analyzed using the imaging technique using biovess root scanner for evaluation of the roots of the selected plants.

Result

From the study that there was a huge variation in the segregants for all the root traits. Plants having a range of root length to be 21.04-44.2 cm, number of root tips from 74-1750, root volume from 1-29 cm³ and the association study revealed that projected root surface area ($r = -0.397$), number of root tips ($r = -0.199$), and number of root forks ($r = -0.372$) were found to have a negative correlation with the yield, whereas root volume ($r = 0.212$), root dry weight ($r = 0.268$) and average root diameter ($r = 0.262$) were highly significantly and positively correlated with grain yield per plant. The genotypic evaluation of the sample population from the F₂ segregating population conducted using the SSR markers linked to root traits assisted in selection of superior segregants with superior root traits on the basis of polymorphic studies and a total of having banding pattern similar with the drought tolerant parent.

Conclusion.

Superior segregants having higher yield and similarity in the genotypic constitution with the drought resistant having superior root traits were identified which could be further utilized for various breeding and hybridization programs.

Key word : root traits, drought tolerant linked root system, rice, root/ yield association, segregating generation, F₂ generation, root scanner, root imaging analysis

Evaluation Of Botanicals On Major Insect Pests Of Okra

Dr. Pradnya S. Kadam*, M. N. Watti, Dr. Sunita N. Suryawanshi and Dr. M. N. Ingole.

Pulses Research Unit, Dr. Panjabrao Deshmukh Krishi Vidyapeeth Akola, Maharashtra 444104(India).

Purpose

Okra or Lady's finger (*Abelmoschus esculentus* (L.) Monech) is one of the favorable vegetable crops in India. It is well known for its high nutritive value and medicinal use. This crop is infested with number of insect pests like aphids, whiteflies, leafhopper and shoot and fruit borer, causing considerable damage to the crop and result in heavy yield losses. In general, the overall damage due to insect pests accounts to 48.97 per cent loss in fruit yields. Attempts to control the pests by insecticides generally results in resistance, secondary outbreak, phytotoxicity, toxicity to beneficial organisms and residues in food which cause health hazards to the consumers. Moreover, in crops such as okra, the short interval between picking of fruits poses the residue hazards to the consumers when the chemical insecticides are used. Hence research workers have started searching out the effective, environmentally safe, eco-friendly and bio-intensive management tactics which may keep pest below ETL and become a part of Integrated pest management.

Although use of insecticides cannot be altogether omitted as they form the main stay of pest management strategies, yet their role can indubitably be limited by utilizing safer techniques of pest management such as biopesticides (plant derivatives and microbial insecticides), growing of pest tolerant/ resistant varieties and utilizing bio agents in an eco-friendly integrated pest management package. By considering all the above statements, present study was objectified to evaluate different plant extracts against sucking pests and fruit borer (*E. vitella*).

Objectives: 1. To test the bio-efficacy of botanicals on major pests of okra.

2. To work out the incremental cost benefit ratio (ICBR) of treatments.

Methodology

1. Variety : AKOV-118
2. Design of experiment : Randomized Block Design
3. Number of treatments : 8 (Eight)
4. Number of replications. : 3 (Three)

Sr.No.	Treatments	Common name	Concentration of spray solution
1.	T ₁	Neem oil	2%
2.	T ₂	Neem oil	3%
3.	T ₃	Neem seed extract	5%
4.	T ₄	Neem leaf extract	10%
5.	T ₅	Karanj oil	1%
6.	T ₆	Garlic bulb extract	3%
7.	T ₇	Quinalphos	0.05%
8.	T ₈	Control (water spray)	–

In all four sprays was undertaken at an interval of 10 days. The observation was recorded on various major pests *viz.* aphid, leafhopper, whitefly and shoot and fruit borer and also recorded marketable fruit yield.

Sucking pests

Pretreatment observation on sucking pests *viz.* aphid, leafhopper and whiteflies were taken 24 hrs. before spray from randomly selected 5 plants. The observation will be taken from top, middle and bottom leaves and accordingly average will be calculated. Post treatment observation were recorded at 3, 7 and 10 days after each spray.

Shoot and fruit borer

For shoot and fruit borer damage, number of healthy and damaged fruits due to borer were recorded at 3, 5 and 7 days after each spray in plot. At the time of every picking damaged fruit and healthy fruit were counted on number and weight basis to workout percent infestation of shoot and fruit borer. Accordingly per cent shoot and fruit borer was calculated.

Results:

The results revealed that treatment Quinalphos 25 EC @ 0.05% was found most effective and economically viable for the control of okra aphids, whiteflies, leaf hopper and shoot and fruit borer. Amongst the botanicals Neem oil 3% and NSE 5% found most effective to control of aphid population, while Neem oil 3% and 2% found most effective for management of leafhopper and whitefly. The effectiveness of the botanicals observed in present investigation is in conformity with Ayyanar *et al.* (2017) reported the Neem oil 3%, Garlic bulb extract 10% had moderate efficacy

against leafhopper. Neem oil 3%, 2% and NSE 5% are most effective to reduce the shoot and fruit borer infestation. During study there were no deleterious effect of insecticidal treatments was found on Lady bird beetle (adult and grubs) and spiders. The effectiveness of the botanicals observed in investigation is in conformity by Chorage *et al.* (2012) using NSE 5% which was recorded the fruit infestation on number basis 16.92% and on weight basis 17.07%. Also, the Pachole *et al.* (2017) reported that, Neem oil 3% recorded 12.99%, NSE 5% 15.24% and Neem leaf extract 5% 17.94% fruit infestation.

As regards to the highest yield of okra fruits 50.53 q/ha was obtained in Quinalphos 25 EC @ 0.05% Followed by Neem oil 3% (47.62 q/ha), Neem oil 2% (45.60 q/ha) and NSE 5% (43.28 q/ha). As far as economics of the treatments is concerned, of Quinalphos 25 EC @ 0.05% followed by NSE 5%, and Karanj oil 1% are most economic treatments recorded an ICBR of 1:12.53, 1:6.35 and 1: 4.06 respectively.

Conclusions:

1. For the management of sucking pests of okra i.e. aphid, whitefly, leaf hopper and also shoot and fruit borer, Quinalphos 25 EC @ 0.05% was found most effective.

i) Neem oil 3% and NSE 5% found most effective for the management of sucking pests population on okra.

ii) Neem oil 3%, 2% and NSE 5% are most effective to reduce the shoot and fruit borer of okra.

3. All the botanical treatments found safer to natural enemies (Spider and LBB) as compare to Quinalphos.

4. The application of Quinalphos 25 EC @ 0.05% recorded the maximum yield of okra. While the treatment of Neem oil 3% and 2% have also be performed better and found promising.

5. The highest Incremental Cost Benefit Ratio (ICBR) was observed in the treatment Quinalphos 25 EC @ 0.05% and followed by NSE 5% and karanj oil 1%

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Physiological and biochemical response of mothbean genotypes to supplemental irrigation under limited water availability

Vasundhara Sharma^{1*}, N. S. Nathawat², Mukesh Kumar Berwal³, Chetan Kumar Jangir¹ and S. N. Saxena¹

¹ICAR-National Research Center on Seed Spices, Ajmer-305206, Rajasthan, India, ²Regional Research Station, Central Arid Zone Research Institute, Bikaner-334004, Rajasthan, India and ³ICAR-Central Institute for Arid Horticulture, Beechwal, Bikaner-334006, Rajasthan

Purpose:

Increasing temperature and irregular rainfall patterns due to climate change in arid and semi-arid region of mothbean cultivation lead to drought conditions especially under rainfed growing system. Supplemental irrigation at critical crop growth stage in mothbean genotypes can help in increasing the growth, productivity and economic returns under water deficit situations.

Methods: In this respect, field experiment was conducted to assess growth, physio-biochemical responses, yield and drought tolerance indices with seven contrasting genotypes of mothbean, viz. RMO-257, RMO-40, RMB-25, RMO-2251, CZM-45, RMO-435 and RMO-225 under rainfed (RF) and supplemental irrigation (SI, one irrigation applied before on set of flowering) conditions.

Result:

Results showed that mothbean genotypes performed better in terms of plant growth, physiological parameters such as plant water status and enzymes activity in supplemental irrigation condition as compared to rainfed condition. The rainfed condition significantly increased antioxidative enzymes i.e. ascorbate peroxidase and guaiacol peroxidase in the tolerant genotypes. The genotypes RMO-257, RMO-40 and RMB-25 had higher values for growth, physio-biochemical attributes, yield and drought tolerance indices as compared to other genotypes under rainfed conditions.

Conclusion: SI can significantly improve the physiological and biochemical responses of mothbean genotypes and drought resistant genotypes proved to be more yielding under limited water availability, which can be further exploited in breeding programs for drought resistance.

Keywords: *Vigna aconitifolia*; Drought stress; Rainfed; Supplemental irrigation; Antioxidative enzymes

Breaking Of Interspecific F1 Hybrid Male Sterility Using Conventional Method In Chilli

B. V. Tembhurne, Rohit Kumar, Manoj, A. R. Kurbar And Gururaj Sunkad

Department of Genetics and Plant Breeding University of Agricultural Sciences, Raichur Karnataka, India

Purpose

Chilli (*Capsicum annuum* L.) is one of the most important commercial crops, grown in almost all parts of the world as well as in India. Anthracnose (*Colletotrichum capsici*) and powdery mildew (*Leveillula taurica*) are the major diseases of chilli. Chemical method of managing anthracnose and powdery mildew diseases is not sustainable and is also associated with health hazards and environmental pollution. The resistant source of powdery mildew is available in *C. annuum*. However, both powdery mildew and anthracnose disease resistant source is found in *C. baccatum* species. Use of bridge species and or embryo rescue are only the techniques to transfer the anthracnose resistant gene from *C. baccatum* to *C. annuum* due to cross incompatibility between these 2 species. Therefore, the crossing programme was initiated to transfer resistant gene from *C. baccatum* to *C. annuum* using conventional methods.

Methods

The large number of direct as well as reciprocal single crosses were attempted to enhance the cross compatibility between *C. annuum* and *C. baccatum*. The male sterility as well as non male sterility based hybrids belongs to *C. annuum* x *C. annuum* also used as female parent to develop the three way crosses.

Results

It was found that the interspecific cross was compatible when male sterility based hybrid UARChH42 (*C. annuum* x *C. annuum*) used as female and PBC80 (*C. baccatum*) as male parent.

The population of interspecific hybrid so produced was completely sterile as well as partial fertile. Large number of back crosses (BC1F1) were attempting using newly developed partial fertile plants as female and male sterility based hybrid UARChH42 as male parent. We could able to get single fruit having 2 seeds with filled embryo and 2 seeds without embryo during kharif 2020-21. Both the seeds filled with embryo were germinated and grown into well developed plants. Among the two plants one was sterile and another was partial fertile. Partial fertile plant was cross compatible when sterility based F1 hybrid used as male parent. However sterile plant was incompatible. Out of 4 plants developed in BC2F1 population one plant was completely fertile, 2 were partial fertile and one was sterile. Among the 4 plants 3 plants were cross compatible with each other as well as any other genotypes belongs to *C. annuum* as well as *C. baccatum*. We developed large number of cross combinations (BC3F1) as well as selfed progenies using completely fertile and partial fertile plants. The resistance to anthracnose and powdery mildew was confirmed using infector fruit attached and infected plant attached methods respectively. The confirmation of anthracnose as well as powdery mildew resistance using molecular marker is under progress.

Conclusions

The newly developed fertile plant resistance to anthracnose as well as powdery mildew resistance shall be further utilized for commercial cultivation after confirmation of homozygosity and conducting multilocational trials. As all the three types of plants were cross compatible with *capsicum annuum* species it is now possible to produce resistant high yielding hybrids for both anthracnose as well as powdery mildew diseases.

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Environmental pollution and disaster management an analytical study

Vijai Luxmi Yadav

Department of Political Science

Purpose

Many environmental disasters occurring in the present time, such as human life and the living world, will be affected. All these natural disasters are full of human pollution in many ways. Challenges will continue to be present, if humans have to live peacefully, then it is necessary for them to study the relationship between natural disaster and environmental pollution and try to stop it.

Methods

While studying the inter-relationship between environmental pollution and natural disaster, it is necessary to pay attention to the fact that what kind of environmental tampering has been done in a particular area and as a result, what kind of disaster has come in the area. It is necessary for this comparative study method and analytical study method will be used.

Results

As a result of the study it was concluded that natural tampering has actually invited natural calamities and as a result, there has been a huge loss of life. For the safety of human life and other animal world, it is necessary that minimum natural tampering should be done.

Conclusions

Natural disasters do not happen spontaneously. If there is a reduction in the number of natural disasters, then humans will have to interfere in natural activities at least, only then humans and other creatures can live their lives on earth peacefully and safely. Man has to assuming that this earth belongs to all the living beings.

Keywords: environment, disaster, tempering, method, analytical, natural.

Stability of maize hybrids developed through integration of rapid cycle genomic selection and doubled haploid technology for heat stress tolerance

Swamy, N¹., P. H. Kuchanur^{1*} , P.H. Zaidi², Vinayan M.T²., Ayyanagouda Patil¹, Arunkumar B¹., Sowmya H.C¹. and Dhanoji M.M¹.

¹University of Agricultural Sciences, Raichur-584104, Karnataka, India.

²International Maize and Wheat Improvement Center Asia Regional Programme, ICRISAT, Patancheru-502324, Hyderabad, Telangana State, India.

Purpose

Climate change will be the major impediment to agriculture and it will be greatest in the tropics and subtropics. In relation to this, South Asia is likely to be more vulnerable to multiple stresses. Maize is highly productive under optimal environmental and crop management conditions, but climate induced stresses like drought, waterlogging, salinity, heat, cold, diseases and pests which often come in combinations to severely impact maize production. Heat stress is also becoming major constraint to maize production (Prasanna *et al.*, 2021). The rise in temperature beyond threshold level can cause irreversible damage to crop growth and yield. There is a limited literature on the stability of tropical maize cultivars for heat stress tolerance. The objective of the present study was to assess the stability of hybrids which were derived through the integration of genomic selection and doubled haploid technology under heat stress, optimal and early spring conditions.

Methodology

The CIMMYT-Asia Regional Programme, ICRISAT, Hyderabad has developed multi-parental synthetic population1 (MPS1, Heterotic group A) and multi-parental synthetic population2 (MPS2, Heterotic group B) by using elite lines. These populations were further improved for heat stress tolerance through genomic selection. Later, doubled haploid (DH) lines were produced from the improved cycles of MPS1 and MPS2. The DH lines produced from improved cycles of MPS1 and MPS2 were then testcrossed with a tester, CML-451 belong to Heterotic group B. A total of 111 maize DH testcrosses derived from Cycle1, Cycle2 and Cycle3 of MPS1 and MPS2 along with six commercial check hybrids formed the material for the evaluation. The experimental material was evaluated under three temperature regimes *viz.*, heat stress, optimal and early spring condition during summer 2018, *kharif* 2018 and *rabi* 2018-19, respectively at Agriculture College Farm, Bheemaranagudi and Main Agricultural Research Station Farm, Raichur, by adapting alpha lattice design with two replications. Eberhart and Russell (1966) model was used to analyse individual genotype performance and adaptability to varying environments.

Results

The combined ANOVA across locations and environmental situations revealed that, the mean sum of squares due to cycles, populations and its interaction with environment and location were found significant for grain yield ($t\ ha^{-1}$) which indicated the diversity and substantial variation present in the material used for the study and their good response to different environmental situation and location for the trait.

The Analysis of stability parameters for grain yield of maize testcrosses showed that, among the 111 testcrosses and six checks analysed under heat stress and early spring condition, the testcross,

CML451/(MPS-1-C2GS)-DH7 was identified as stable, as it recorded high mean grain yield (5.476 t ha^{-1}) than population mean, β_i value nearer to unity (0.905) and non-significant S^2d_i (-0.295). This entry also performed well under *kharif* season. Thus inferred that, the entry would perform well under all the environments.

The testcross CML451/(MPS-1-C2GS)-DH56 and check 900MG recorded above average stability with β_i value lesser than unity with non-significant S^2d_i and high mean grain yield, hence categorized as adaptable to unfavourable environments. Twenty testcrosses recorded below average stability with β_i values greater than unity with non-significant S^2d_i and high mean grain yield, hence they were categorized as adaptable to favourable environments. The remaining 89 testcrosses exhibited significant differences for deviation from regression and they were remarked as non-significant, it would suggest that the behaviour of these genotypes was unpredictable. Previously, Pavani *et al.* (2019) identified the hybrids *viz.*, RCRMH-12 and RCRMH-4 as stable and superior for grain yield under stress and optimal conditions. Patil (2021) also identified two stable hybrids from MPS 2 population, whereas, none of the hybrids were categorised as stable from MPS 1. However, hybrids *viz.*, ZH2092, ZH2082, ZH2069, ZH2086 and ZH2051 were identified as above average hybrids and the hybrids *viz.*, ZH203, ZH2096, ZH2093 and ZH2094 were identified as below average hybrids under heat stress condition.

Conclusion

From the present study, CML451/(MPS-1-C2GS)-DH7, which recorded stable yield under heat stress and early spring condition and performed well under *kharif* season, was identified as the climate resilient maize hybrid. Therefore, this hybrid needs to be tested extensively at different locations under different seasons and situations for its suitability for commercialization besides using the DH line in development of new lines and hybrid combinations.

Keywords: Maize, heat stress, rapid cycle genomic selection, doubled haploid, stability analysis

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Citrus indica: A Journey from Herbal Medicines to Tea

Upasana Deb, Sheena Haorongbam

Dept. of Agribusiness Management and Food Technology, NEHU, Tura Campus

Purpose

Citrus indica, the progenitor of oranges, is found in the Garo Hills of Meghalaya and has been used by the locals for the treatment of various ailments. However, the fruit is seasonal and the fruit in general is rarely consumed due to its sourness. Therefore, an attempt has been made to introduce the fruit in the diet of people by value addition and making a blend of black tea with its dried peel, so that people can enjoy its goodness the whole year.

Methods

Standardization of the tea composition was done. For that, various ratios (50:50, 60:40, 70:30, 80:20, 90:10) of black tea and the fruit peel respectively was considered. One teaspoon of the tea composition was taken in a tea ball infuser and then dipped in a cup of boiling water for 2 minutes. The tea ball was removed. Sensory evaluation of the five teas were done by ten panellists using 9-point hedonic scale. Descriptive analysis of the tea was also done. The tea composition with maximum score was taken as the final product.

Results

The dried peels of *C.indica* had no aroma or taste. So, when the teas were tasted only the taste and aroma of black tea was felt. The flavours of tea increased with increased composition of tea leaves. Hence, the ratio with 90:10 composition of tea and peels respectively was preferred by the panellists.

Conclusions

The introduction of *C.indica* in tea could act as a nutraceutical as the goodness of *C.indica* will get incorporated into tea, without changing its flavours. However, further study on the composition of the final product needs to be done to see the amount of nutrition the tea carries.

Keywords: *C.indica*, black tea, blend, standardization, hedonic scale

WOMEN EMPOWERMENT THROUGH SELF HELP GROUPS IN ROLPA DISTRICT OF NEPAL

Elina Sen¹, Dr.Kalyan Ghadei².

¹Research Scholar, Department of Extension Education, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, U.P., India

²Professor, Department of Extension Education, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, U.P., India

Purpose:

Self-help groups is something that the most strong and easiest tool for women's empowerment to satisfy their criteria for their development. The numbers of these SHGs are increasing in rural community of Nepal through various organizations so, it is necessary to know that whether these groups empower women in terms of various dimensions or not. Thus, the present research was designed to study empowerment of rural women through self-help groups.

Methods:

The data were analyzed by using following statistical tools such as frequency, percentage, arithmetic mean and standard deviation. The data were collected by using the structured interview schedule and multistage random sampling was used to collect data.

Results:

Majority of respondents reported increased in decision making, self- confidence, self – reliance and access for income whereas majority of respondents reported that there was no change in awareness on political affairs and legal awareness.

Conclusions:

women have been greatly supported by self-help groups to recognize their rights, access to information, economic independence and access to credit. It is also discovered that the members involved in SHGs created confidence for social and economic self -reliance.

Keywords: Self Help Groups, Women empowerment, organizations, self- reliance, awareness

Melia dubia cav. An emerging agroforestry and plantation tree species – a review

M.N. Ramesha^{1,2}, H.C. Hombegowda³, M. Jhenkhar⁴, S.P. Sharath⁵, Sasya Samhita⁵, S.L. Patil⁶, A. Röhl², Manish Kumar⁷, and D. Hölscher²

¹ICAR-IISWC, Research Centre, Ballari, Karnataka. 583104, India

²Tropical Silviculture and Forest Ecology, University of Goettingen, Büsgenweg 1, 37077, Göttingen, Germany

³ICAR-IISWC Research Centre, Udthagamandhalam, Tamil Nadu, 643004, India hombegowdaars@gmail.com

⁴Department of Biogeochemistry of Agroecosystems, University of Goettingen, Büsgenweg 2, 37077, Göttingen, Germany

⁵Plant Ecology and Ecosystems Research, Albrecht von Haller Institute for Plant Sciences, University of Göttingen, Göttingen, Germany

⁶ICAR - IIPR, Regional Research Centre, Dharwad, Karnataka. 580 005, India

⁷Ecophysiology and Vegetation Ecology, Julius-von-Sachs-Institute of Biological Sciences, University of Würzburg, Julius-von-Sachs-Platz 3, 97082, Würzburg, Germany

Extended Summary

For augmentation of domestic industrial-wood production and to fetch early income to the farmers, *M. dubia* has been identified as one of the potential native species for plantation and agroforestry to supply industrial wood (Chauha and Chauhan 2011, Parthiban *et al.* 2021). The plantation of the species was initiated by a plywood company, Hunsply, in Karnataka, India in nineties (Hunsply 2022). The fast growth and wide adaptability of species coupled with intensions of promoting native species by State forest departments, academia and private enterprises, established *M. dubia* as main agroforestry and farm forestry tree species in the country. Despite this reported potential of the species to supply wood products, sufficient research has not yet been conducted to analyse the growth potential under different climatic regimes and management practices for assured economic returns. In order avoid, just-like-jatropha (*Jatropha curcas* L.) story of hope to despair (Singh *et al.* 2014), as jatropha narratives were built with wishes and beliefs on a narrow scientific discourse without facts for supporting potential claims (Singh *et al.* 2014, Trebbin 2021). Hence, thorough evaluation of the existing scientific literature for *M. dubia* is essential to uphold the hype and to develop future scientific discourse and technological backup for its promotion.

We performed a keyword search as “*Melia dubia* or *Melia composita* or *Melia birmanica*” to gather all the research papers listed at the ISI Web of Science Core Collection (WOS) database. We collected 69 documents published in English during the year 1969-2022 till 18th February 2022. The bibliometric analysis aims to analyze and visualize the structure of the research field by dividing the items (articles, authors, journals, keywords, or sub-topics) into different groups (Aria and Cuccurullo 2017). In the current study, the literature’s bibliometric analysis was performed in R using the bibliometrix package (Aria and Cuccurullo 2017).

The analysis revealed that most of the published documents originated from the Southeast Asian region and India (Fig. 1a) followed by USA and Vietnam. The most scientific documents were published recently during 2016-2022 (Fig. 1b). It indicates the research booms in recent times due to recognition of *M.dubia* in trade and wood industries. The reviewed covering origin and distribution, cultivation and agroforestry-adoption, growth and yield, wood qualities and uses, genetics and tree improvement aspects were studied to identify the pertinent knowledge gaps.

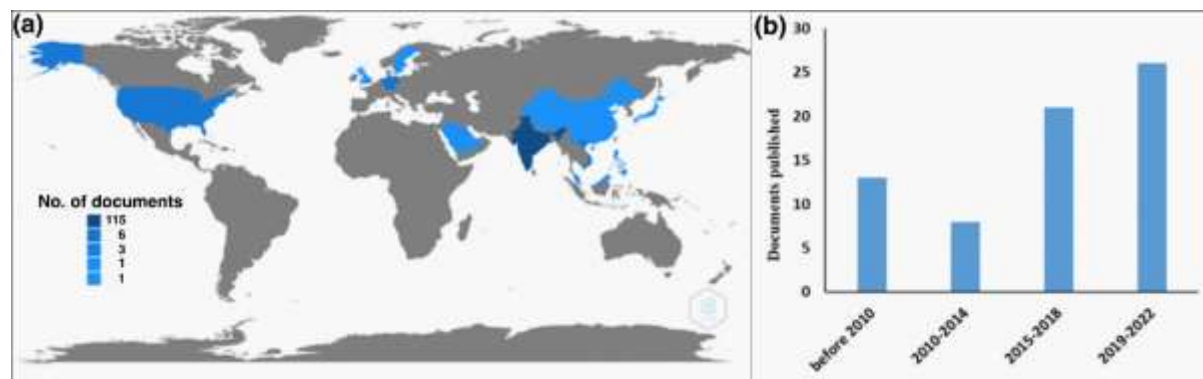


Fig. 1. Number of of documents published across the globe (Fig. 1a) and temporal chronology of publication (Fig. 1b).

The demand for wood and wood products is constantly increasing due to growing human populations and economies, which underscore the need of strengthening the domestic wood production. In India, therefore the native tree species *Melia dubia* Cav. is promoted in tropical farm forestry. We reviewed the state of art and knowledge about its origin and distribution, cultivation and adoption, growth and yield, wood qualities and uses, genetics and tree improvement aspects and pertinent knowledge gaps. Estimated aboveground biomass production rate ranges between 9 to 13 Mg/ha/yr, with an assumptive permanent carbon stock of 22.1 Mg/ha in clear-felling plantation having one-to-nine-year age gradations, keeps the species in comparable and competitive mode with other popular plantation species across India. Wood yields surface veneers which are good enough to make moisture resistant (MR) and boiling water-resistant (BWR) grade plywood. Few studies recommended five-year old wood For paper and pulp industries but some rejects, which also echoed in farmers opinion. Enlisted wood qualities define utility of wood for tool handles, construction, light packing cases and furniture. Nonetheless, reviewed studies largely characterized wood traits of five to six-year plantations. Further, nexus between tree hydraulic and water availability was also established and recommended continuous irrigation in low rainfall regions. Identified contemporary research gaps are lack of species-specific growth models for biomass and carbon sequestration. Tree water requirement, hydraulics and woodlots response to climate change and susceptibility to pest and disease were paid less attention. Information about performance under mixed stands and intercropping is largely missing. Ecological implication of its cultivation on biodiversity and groundwater needs an attention. Therefore, addressing research issues is essential to ascertaining media and academic hype of high value, miracle and money-spinning tree.

Keywords: *Melia dubia*, distribution and growth, wood traits, natives, research gaps.

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Effect of time of planting and bio inoculants on days to opening of 1st floret and floret diameter of *Gladiolus*

Divya¹, Arvind Malik¹, Raveena²

¹ Chaudhary Charan Singh Haryana Agricultural University, Hisar (125004), Haryana
² Maharana Pratap Horticultural University, Karnal (132001), Haryana

Purpose

Gladiolus is the leading flowering plant in the international cut flower trade. It is grown for its beautiful spike worldwide and is known as the queen of bulbous flowers. The time of planting and biofertilizers plays a vital role in obtaining better growth and flowering. The time of planting is indirectly related to the temperature and day length, both of which are important for the days to opening of 1st floret and floret diameter of *Gladiolus*. Proper planting time provides optimum growth conditions to plant for better growth with better floret diameter and minimum days to opening of 1st floret. While biofertilizers being a source of nutrients, plays an important role in flower growth and yield of a flower also depends on the nutrient status of the soil. More yield will generate more income for farmers. Keeping in view the above facts, the present study was carried out to study the effect of time of planting time and bio inoculants on the days to opening of 1st floret and floret diameter growth and flowering of *Gladiolus*.

Methods

The number of days taken from the planting of corms to the opening of the first floret in the spike of each tagged plant was recorded, and the average was calculated.

The diameter of the second floret of the spike in each tagged plant was measured by a digital vernier calliper.

Results

The results revealed that the days taken to opening of the first floret differed significantly for different time of plantings and bio inoculants. With a delay in the time of planting, the number of days taken to opening of the first floret increased significantly. The minimum number of days taken to opening of first floret (96.96) were recorded in 1st fortnight of October planting.

Among different bio inoculants treatment, the minimum number of days taken to opening of first floret (96.64) was observed in plants grown under T₈ treatment (RDF + *Azotobacter* + PSB + Mycorrhiza).

Conclusions

Under North Indian conditions *gladiolus* can be planted on 1st fortnight of October and using bioinoculants treatment T₈ (RDF + *Azotobacter* + PSB + Mycorrhiza) to obtain optimum growth and yield. Better yield obtained generate more income for farmer and hence improve economic status of farmers.

Keywords: *Gladiolus*, bio inoculants, time of planting

Climate Change Mitigation Strategies to Grow Quality Apple (*Malus Domestica*) in Dry Land Ecologies of Kashmir Region.**Lareb Mir^{A*}, S. R. Dar^A, J. A. Wani^A, Sameera Qayoom^B, A. R. Malik^C and Owais Ahmad Wani^A**^A *Division of Soil Science, Faculty of Horticulture, SKUAST-K, Shalimar, UT Jammu and Kashmir, India, 190025.*^B *Division of Agrometeorology, Faculty of Horticulture, SKUAST-K Shalimar, UT Jammu and Kashmir, India, 190025.*^C *Division of Fruit Science, Faculty of Horticulture, SKUAST-K Shalimar, UT Jammu and Kashmir, India, 190025.***Background:**

Union territory of Jammu and Kashmir currently produces about 60 percent of total India's apple production. Horticulture governs economic expansion of the Union Territory with yearly turnover of over INR 350 crores. In Kashmir region apple alone constitutes more than 48 percent of area under fruit crops. Apple sector employs almost 7 lakh families and 33 lakh people directly or indirectly, undoubtedly creates job opportunities for the youth in region. In recent times traditional apple orchard plantation system remained most vulnerable to climatic changes, particularly unpredicted snow fall at late harvesting times not only damages fruit crop but established plantation also. Poor adaptability of traditional plantation system to drastic climatic changes not only produce poor quality and production but is a big hurdle to perform modern input saving technique such as drip irrigation, fertigation, mechanical harvesting and mechanical pruning etc. Under changing climate high density plantation system due to early harvesting has potential to fill voids in apple production system by generating better economic returns and perform judicious use of available resources like water and land. Area expansion under high density plantation to mitigate climatic change is primary priority of the government, thus farmer centric scheme on apple high density plantation to cover 5500 hectares in Jammu & Kashmir with 50% subsidy has been recently initiated.

Methodology:

Water scarcity significantly restricts apple cultivation in dryland ecologies of Kashmir zone, so enhancing water conservation is essential for successful apple production in these areas. This study was carried out in order to demonstrate role of mulching and drip irrigation to address water scarcity in shallowed rooted apple high density plantation system. Agricultural sustainability in these ecologies is threatened by climatic variability factors like drought, temperature extremes, erratic precipitation, soil erosion, surface evaporation, delayed crop maturity, poor nutrient response, weed population pressure, advancing and delaying in crop physiological periods led disease incidences. In this study, black plastic mulching and drip irrigation scenarios were tested in high density plantation system to validate potential water saving capability, weed population pressure, quality and yield of apple.

Results:

The results attained from trials carried in Shopian and Budgam districts of Kashmir region reveals that high density plantation system under black polythene mulching and drip irrigation saved 21.9 to 73.9 % water consumption to that of flood irrigated traditional apple planting system. These water saving interventions provided tangible and significant yield gains of 42.7 to 53.7 ton per hectare in high density plantation system. The yield rise compared to traditional plantation system were 280 to 383 %. Weed population pressure in high density plantation system by these

interventions get lessened by 5.6 to 37.3 % than that of traditional planting system. Therefore under changing climatic vulnerability, drip irrigation and mulching are an effective cultivation measures for sustainable development approaches in dryland apple ecologies of Kashmir region.

Conclusion:

Plummeting vulnerabilities is key to lessen net impacts of climatic change on food security and sustainability. Climate change creates extensive uncertainty about future water and other natural resource availability in numerous regions of globe. The mountainous societies are projected to suffer worst. In dryland ecologies of Kashmir region, apple cultivations can be sustained by mitigating climatic issues like water scarcity, soil erosion, nutrient competition with weeds, soil temperature and incidence of diseases and pests. High density plantation provides better quality and yield. Farm mechanization and other field operations are easy to be carried. Early maturing varieties under high density plantation system escapes early snow fall damage that are common in traditional planting system at harvesting time. Field operation are easy to perform in high density plantation.

Keywords: Apple, high density plantation, water scarcity, drip irrigation, mulching and climatic changes.

Comparison of selected Seagrass extracts against larvae of day biting mosquito *Aedes aegypti* (L.) and night biting mosquito *Culex quinquefasciatus* (say)

D. Monisha, M. Prabhakaran

Chellammal Women's College, Chennai, India

Purpose:

Seagrasses are abundantly present in the aquatic biodiversity that have all the pharmacological efficacies such as antimicrobial, anti-mosquito larvicide, antioxidant, antipyretic and antitumor. Mosquitoes are dreadful vectors since it bites the living communities for blood. It is important to note that some seagrasses were reported to have a mosquito larvicidal activity against *Aedes aegypti*, *Culex quinquefasciatus* and *Culex pipens*. Therefore, the current research aims to compare the different Seagrass extracts against mosquito larvae of *Aedes aegypti* (L.) and *Culex quinquefasciatus* (say)

Methods:

The potent extracts were subjected to bio guided fractionation assay and the active compound were subjected to characterization studies such as UV-Visible Spectrophotometer, FTIR, ¹H NMR and GCMS Analysis. The application studies such as histopathological studies, Non target effect of seagrass against beneficial fishes *Poecilia reticulata* and *Gambusia affinis* were studied. Finally, the binding energy of compound against *ace1* receptor of mosquito was analyzed.

Results:

From various characterization and application studies it was found that phytosterols of seagrass are responsible larvicidal activity. From the *In silico* docking analysis the phytosterols showed very good binding interaction. The phytosterols as synergistic or individual existence, has the ability to perform a significant role in the control of mosquito larvae that are harmless for other organisms and environment. In the future, this can be applied in field trials for the complete examination of the next advanced level of research. So it is recommended that people should be empowered with adequate knowledge on seagrass extract-based insecticides and others to take the necessary actions at the community level to prevent mosquito-borne diseases.

Keywords: Seagrass based extracts, phytosterols, mosquito larvicidal activity, histopathology

Effect of potting mixture on growth and development of quality planting material of *Bambusa balcooa*.**Prashant D. Raut¹, Vijay M. Ilorkar² And Aarti P. Deshmukh³***All India Co-ordinated Research Project on Agroforestry, College of Agriculture, Nagpur (Dr. PDKV, Akola), Maharashtra, India.***Purpose**

Bamboo is one of the important forest species used in paper industry, house construction, ornaments making *etc.* Most of the bamboo species are propagated both by seeds and vegetative means. *Bambusa balcooa* is mainly multiplied by seeds, culms, rhizomes *etc.* The seedlings in the nursery usually vary in vigor and other growth characters. Therefore, production of good quality seedlings is an important step for ensuring uniform plantation. Seedling quality can be improved.

Materials

The nursery pot mixtures were prepared by using different media and manure as per the following details. The Treatments are T₁- Garden soil alone; T₂- garden soil + Cocopit (1:1); T₃- garden soil + FYM (1:1); T₄- garden soil + Vermicompost (1:1), T₅- cocopit + FYM (1:1), T₆- garden soil + neem cake (1:1), T₇- garden soil + poultry manure (1:1), The different nursery mixtures were filled separately in the polythene bags (8 x 12 Inch) in four replications comprising of 25 bags in each replication by following the completely randomized design. The bamboo saplings having a height 25 cm are planted in polythene bags filled with different potting mixtures and watered regularly for the proper growth of saplings. The survival per cent and other growth characteristics were recorded six months after planting. The data were analyzed using the statistical method described by Panse and Sukhatme (1967) and the critical difference values were calculated at 5% probability level.

Results

The saplings in the nursery will vary in vigour and other growth characters. It is important that only vigorous seedlings are selected for planting (Farooqi and Sreeramu, 1999). The vigour of the saplings is highly influenced by the nursery pot mixtures. In the present investigation, the results showed that the treatment T₃ recorded significantly maximum height (93.75 cm) of tillers in potting mixture of garden soil + FYM (1:1) as compared to other treatment. It was followed by treatment T₄ (garden soil + Vermicompost (1:1)). Whereas, lowest height (38.75 cm) of tillers was recorded in garden soil + cocopit potting mixture (1:1). Similar results of pot mixture containing soil: sand: Vermicompost / soil: sand: goat manure gave higher germination and vigorous seedlings in *Albizia lebbek* (Natarajan, 1999) and arecanut (Raja *et al.*, 2002). Raja *et al.*, (2012) also recorded maximum height of *Bambusa tulda* saplings in soil + sand + Vermicompost potting mixture (2:1:1).

Significantly maximum number of branches was recorded in treatment T₃ (3.25) in comparison to other treatments. The base diameter was high (7.50) in the treatment T₃ (garden soil + Vermicompost (1:1)). The next best treatment *viz.*, T₄ (garden soil + Vermicompost (1:1)) produced 5.75 number of branches which had no significant difference with previous treatment. Garden soil + cocopit (2.50) and garden soil + neemcake (2.75) recorded minimum number of branches during six months after transplanting of tiller (table1). Among the treatments, the maximum number of internode per tiller (8.00) and internode distance (11.25 cm) was recorded in treatment T₃ (garden soil + Vermicompost (1:1)) These characters was least recorded in treatment (T₂ : Garden + cocopit (1:1), respectively). No significant difference was observed in regards with new tillers and total

number of tillers amongst the different treatments. Significantly maximum weight of tillers (119.50 gm) was reported in treatment T₃ (garden soil + FYM (1:1)). It was followed by treatment T₄ (garden soil + Vermicompost (1:1)). Whereas, lowest weight of tiller (17.75 gm) was reported in potting mixture of garden soil + cocopit (1:1). The significant growth characteristics viz., height of tillers (cm), number of branches, base diameter (mm), number of internode, internodal length and weight of tillers was recorded maximum in potting mixture contacting garden soil with FYM and Vermicompost. Sreekrishna Bhat, (1999) found that the vermicompost acts as a good pot mixture because it contains rich nitrogen (1.5-2.5%), phosphorus (0.9-1.7%), potassium (1.5-2.4%), Magnesium (0.2-0.3%), calcium (0.5-1.0%), sulphur (0.4-0.5%) and vitamins. It also has growth hormones like gibberellins, which regulate the plant growth. It can supply full requirement of micronutrients and enhances the availability of both native and added micronutrients in soil (Purakayastha and Bhatnagar, 1997). The farmyard manure has 0.5 % nitrogen, 0.2% phosphorous and 0.5 % potassium which are slightly higher in poultry manure (3.03% N, 2.63% P, and 1.4 % K) (Sankaranarayanan, 2004). This might be the reason for enhanced performance in bamboo seedlings. The increased nutrient level in poultry manure might be the cause of the seedling vigour improvement in the bamboo after the Vermicompost treatment. The Vermicompost has the additional nutrients and vitamins other than nitrogen, phosphorous and potassium which showed positive effect on the seedling vigour. The other treatments including cocpit, neemcake had no significant effect on the performance of the seedlings.

Conclusion

It is concluded that the pot mixture comprising of soil + FYM (1:1) have recorded the maximum height of tiller, number of branches, base diameter, number of internode, internodal length and weight of tiller. Therefore, this pot mixture can be recommended for getting the vigorous seedlings through saplings propagation. Maximum number of offsets produced can also be separated for further vegetative propagation or planting.

Keywords: Bamboo, *Bambusa balcooa*, neemcake, poultry manure and Vermicompost.

***In Vitro* Evaluation Of Organic Amendments Against *Alternaria Solani* Caused Early Blight Of Tomato**

Patil M. G.¹, Bhalerao Ambadkar C.V.³

Department of Plant Pathology, College of Agriculture,

Vasntrao Nail Marathwada Krishi Vidyapeeth, Parbhani, (M.S.) 431402, India

Purpose

Tomato (*Solanum lycopersicum* L.) is a popular vegetable and fruit crop in the Solanaceae family. It is a very versatile plant that is used in both natural (raw material) and as an ingredient in other products. Tomato yield in India is low when compared to other developed countries due to the attack of various diseases caused by fungi, bacteria, viruses, and nematodes. *Alternaria solani* is the fungus that causes early blight (Ellis and Martin). *A. solani* causes disease (leaf blight, stem rot, fruit lesions) and severe damage across the country at all stages of plant development. The disease is currently managed through the use of several conventional fungicides, but due to the development of resistance in most common pathogenic fungi against fungicides, as well as the factors of exposure risks, fungicide residues, and human health hazards, there has been a push for alternative control methods for *A. solani*. Control measures that are both ecologically sound and safe for the environment must be implemented. Use of organic amendments against *A. solani* was the best method for the management of this disease. The result obtained from the evaluation of different organic amendments against *A. solani* in pot culture, revealed that all treatments

significantly reduced the incidence of early blight on tomato cv. Pusa ruby over untreated control. lowest disease incidence were recorded in poultry manure (13.30%) followed by neem cake (15.23%) and goat manure (15.67 %), whereas highest disease incidence were recored in jivamrut (20.98%), vermiwash (21.97%) respectively as compare to control (22.36%).

Methodology:

Soil amendmets at the rate of 10 gm/ kg of soil was mixed with 2.5 kg of soil in an earthen pot of 3.0 kg capacity each and mixed thoroughly for uniform distribution. The amended soils were left to recycle for a period of 25 days with adequate moisture maintained. 3 replication of each treatment was maintained along with un-amended pots serving as check. Susceptible Indian tomato variety Pusa ruby was undertaken for the study. 10 seeds/ pot were planted and adequate moisture required for seed germination was provided. Germination percent for each treatment along with that of the control check was taken at 25 days after sowing (DAS). Disease scoring for *A. solani* was done using the standard 0-9 scale. And plant disease index was recorded at 45, 60, and 75 DAS using formula provided below. Germination percent of the seed was calculated by using formula,

$$\text{Germination percent} = \frac{\text{No.of total seed germinated}}{\text{Total no. of seed sown}} \times 100$$

Standard disease rating scale (0-9 grade) for accessing PDI of early blight of tomato

Rating scale	Description
0	No symptoms on the leaf.
1	Small, irregular brown spots covering 1 per cent or less of the leaf area.
3	Small, irregular, brown spots with concentric rings covering 1-10 per cent of the leaf area.
5	Lesions enlarging, irregular, brown with concentric rings covering 11-25 per cent of the leaf area.
7	Lesions coalescing to form irregular brown patches with concentric rings. Covering 26-50 per cent of the leaf area. Lesions also on stem and petioles.
9	Lesions coalescing to form irregular, dark brown patches with concentric rings covering 51 per cent or more of the leaf area. Lesions on stem and petioles.

The data obtained on blight incidence was computed for estimation of the percentage incidence, applying following formula.(Mayee and Datar 1986)

$$\text{Disease incidence (\%)} = \frac{\text{Number of plants showing disease symptoms}}{\text{Total number of plants observed}} \times 100$$

In vitro evaluation of organic amendmets against *Alternaria solani* (Pot culture)

Soil amended with different source of organic amendmets viz., neem cake, poultry manure, vermiwash, farm yard manure, vermicompost, goat manure, jivamrut, cotton cake were evaluated against *Alternaria solani*. Disease incidence was recorded for each treatment with control at various days i.e (45, 60 and 75 DAS) using 0-9 scale.

Table. 1 Effect of different organic amendmets on disease incidence caused by *A. solani*

Tr. No.	Disease incidence (%)			Mean DI (%)
	45 DAS	60 DAS	75 DAS	

Neem cake	14.03 (21.99)	14.75 (22.57)	16.91 (24.27)	15.23 (22.64)
Poultry manure	12.12 (20.36)	12.38 (20.59)	15.42 (23.11)	13.30 (21.35)
Vermiwash	17.85 (24.98)	18.72 (25.62)	29.34 (32.78)	21.97 (27.79)
Farm yard manure	13.36 (21.45)	14.25 (22.35)	20.33 (26.79)	15.98 (23.46)
Vermicompost	15.34 (23.04)	14.47 (22.35)	19.90 (26.48)	16.57 (33.95)
Goat manure	13.82 (21.81)	13.53 (21.57)	19.67 (26.32)	15.67 (23.23)
Jivamrut	17.36 (24.61)	18.74 (25.64)	26.84 (31.19)	20.98 (27.14)
Cotton cake	15.42 (23.11)	15.72 (23.35)	22.66 (28.41)	17.93 (20.49)
control	18.37 (25.37)	20.30 (26.77)	28.42 (32.20)	22.36 (28.11)
S.E.±	0.11	0.07	0.11	...
C.D. (P = 0.01)	0.35	0.22	0.33	...

*: Mean of three replications,

Figures in Parentheses are angular transformed values

The data presented in (Table 1) depicted the response of different organic manures on the disease incidence of tomato crop. The results indicated that all the treatments were significantly reduced the disease incidence. Maximum germination percent was found in poultry manure (80%) followed by neem cake (70%), goat manure (60%), farm yard manure (60%), vermicompost (50%), cotton cake (60%), jivamrut (50%), vermiwash (50%). The minimum disease incidence was recorded in poultry manure (13.30%) followed by neem cake (15.23%), goat manure (15.67%), farm yard manure (15.98%) and vermi compost (16.57%), cotton cake(17.93%), jivamrut (20.98%), vermiwash (21.97%) as compare to control (22.36%).

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Climate resilient agroforestry

N.L. Deepthi Dechamma^{1*}, G.M. Devagiri², Supriya K. Salimath¹, P.A. Clara Manasa¹ and M. N. Ashwath³

¹ Department of Silviculture and Agroforestry, College of Forestry, Ponnampet, KSNUAHS, Shivamogga, Karnataka, India.

²Department of Natural Resource Management, College of Forestry, Ponnampet, KSNUAHS, Shivamogga, Karnataka, India.

³ Department of Forest Biology and Tree Improvement, College of Forestry, Vellanikkara, Kerala Agricultural University, Thrissur, Kerala, India.

Purpose

Globally, the accelerating pace of climate change, combined with population and income growth threatens food security. Nature-based solutions such as agroforestry provide effective ways to increase carbon storage, while also promoting sustainable economic development. Climate resilient agroforestry systems or practices are the age-old practice in which trees, crops and sometimes livestock are integrated within managed farmland, such that these practices can provide range of goods and services to the people even during extreme climatic conditions.

Methodology

A systematic review analysis was done to summarize how proper selection and combination of species with adaptation capacities to extreme climatic and soil conditions, arrangement and management of these species can increase the resiliency of the agriculture systems.

Results

There are many studies on how agroforestry are the resilient land use systems that provides multiple ecosystem services. This study summarizes on how proper selection, combination and management of species in the farming system can increase climate resilience as studied by various researchers in different traditional agroforestry systems.

Conclusion

Researchers across the world have identified some nature-based solutions to cope with the changing climate, one among them is agroforestry. This review was done to systematically summarize how some of the traditional agroforestry systems across the world increases resilience of agriculture systems to climate extremes.

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Effect of PGRs and ZnSo₄ on fruit drop and morphological parameters of Ber

Madhurima Chaudhuri^{*1}, Ab Waheed Wani¹, Rahul R Rodge¹ Nidhi Chauhan² and Jyoti B Sharma³

Department of Horticulture Lovely Professional University, Phagwara, Punjab 144411

Purpose

This experiment was conducted in Ber (*Ziziphus mauritiana* L) crop. Heavy fruit drop is a major obstacle for expansion of Ber industry in this Punjab region. The bulk of fruit drop occurs at early stage of fruit development i.e, during second fortnight of December. Application of PGRs and

micronutrient alone or in combinations was found to reduce the fruit drop and increase the fruit quality in terms of several morphological and biochemical parameters.

Method

The research trial started in December and was conducted in Horticulture Farm, School of Agriculture Lovely Professional University, and Phagwara. A brief summary of materials and methodology are mentioned below, Ber crop of 7 years of age with no deformed or infestation was selected and tagged subsequently. All the cultural practices and fertilizer applications were done as per the recommendation of the PAU package of practices. The experimental study at the Main Experiment Station of LPU is situated in north-east Punjab (Phagwara), which lies in the centre of the north alluvial plain at the subtropical region. The experiment was laid out in a randomized block design. Plant growth Regulators NAA (20 ppm, 30 ppm) GA3 (30 ppm, 40 ppm), Salicylic acid (300 ppm) and ZnSO₄ (0.5 %) were selected. Time of the spray chosen was during fruit set stage. The research has been carried out for Ber crop. The commencement of this trial started in December 2022.

Result and discussion:

The different spraying treatments of PGRs and ZnSO₄ were given in December, January and untreated control (T0). The results of experiment revealed that foliar application of NAA 30 ppm recorded reduction of fruit drop (85.940%), fruit retention (10.960%) and maximum initial fruit set (89.3 %), fruit weight (30.00 gm), fruit length (4.87cm), fruit volume (14.570 cc) followed by NAA 20 ppm.

Conclusion:

From this study it is concluded that productivity of Ber is enhanced by application of NAA (30 ppm) to increase the farmer economy.

Keyword Ber, Fruit drop, NAA etc

Drought severity and temporal analysis of drought condition in a semi-arid region of south Gujarat, India

K. A. Jariwala, P. G. Agnihotri, Nitin Singh Kachhawa, Shaikh A. A.

Sardar Vallabhbhai National Institute of Technology, Surat-395007, Gujarat, INDIA.

Purpose

Gujarat has an arid to semi-arid climate, frequent droughts, and a persistent water shortage issue. In Gujarat, droughts put a strain on the water resources as well as the agricultural, economic, and societal domains. Although several laws and procedures have been recommended to combat droughts and lessen their effects, drought nevertheless returns to Gujarat every three years and wreaks havoc on people's lives. This research focuses on examining the temporal fluctuations of drought in the Bharuch district, which is situated in the intermediate, arid, and semi-arid climatological zones.

Methods

With a spatial resolution of 0.1 degrees, monthly remotely sensed precipitation data for a period of 40 years, from 1981 to 2021, have been examined. The Standardized Precipitation Index (SPI), Rainfall Anomaly Index (RAI) Deciles Index (DI), Percent of Normal (PNI), and Z score are some of the drought parameters that have been taken into consideration. The applicability of each drought index is compared, and the ground-truthing validation is provided. A consensus was formed after comparing the indices and looking at their correlation to determine the most effective indicator for evaluating and analyzing drought severity.

Results

The average amount of rainfall throughout all divisions is 950 mm. However, each division might show outlier points (more than 1500 mm precipitation, severe rainfall circumstances). The fewest outlier points are clustered around 1439 mm in Jambusar, but exceptional rainfall episodes totaling around 1950 mm are seen in Ankleshwar, Bharuch, Vagara, and Valia. For a time frame of one month, the indices DI, PN, RAI, Z score, and SPI 1 have been computed. In comparison to the other indices, SPI 1 has detected a relatively low number of no-drought and severe drought occurrences, according to the drought categorization. In contrast, SPI has shown a larger number of mild and moderate drought occurrences across all time ranges evaluated. As can be observed, a considerable difference between SPI and PN's analysis of drought severity and DI, RAI, and Z's analysis of drought severity, which does not employ time variation within a year, delivers a more accurate analysis of drought severity.

Conclusions

All indices are compared to check their feasibility for identifying drought categories and their severity, which is quite correlative. Bharuch sub-districts named Ankleshwar a having low drought period, Hansot, Jambusar, and Valia having a high drought period were analyzed based on time scale variation. It is found that the severity of the agricultural drought was more during 1984-1989 and 2000 based on PN, SPI6, and SPI12 in Ankleshwar and the severity of meteorological drought was more during 1992-2000 and 2014-2018 as per SPI1, SPI3 and SPI6. Meteorological drought may happen in the future every consecutive year and agricultural drought every 10 years. Jambusar has the lowest rainfall days amongst all sub-districts of Bharuch; hence, from the temporal analysis, we can say that the severity of meteorological drought is very high in this region, leading to agricultural drought and hence socio-economic impacts are very high proper attention is required for managing resources.

Keywords: Drought, Temporal variation, Statistical analysis, SPI, PN, RAI, DI, and Z score

Evaluation of Frontline Demonstration of new technology on Chickpea (*Cicer arietinum* L.) in Dang district of Gujarat.

P. P. Javiya*, M. J. Baldaniya, B. M. Vahunia, S. A. Patel, K. N. Rana and V. M. Patel

Krishi Vigyan Kendra, Navsari Agricultural University, Waghai, Dang (Gujarat) - 394730

Purpose

In the majority of the area of Dang, chickpea is grown under rainfed condition with neither improved varieties nor with recommended practices. The Krishi Vigyan Kendra, Navsari Agricultural University, Dang has organized 323 numbers of front line demonstrations. This programme is with the objective to demonstrate the improved variety of chickpea (GG 5) for production potential.

Methods

The demonstrated variety GG 5 performed better in all years compare to farmers fields under different scheme of KVK during *rabi* season of 2018-19 to 2020-21.

Results

The demonstrated variety GG 5 performed better in all years compare to farmers fields under different scheme of KVK during *rabi* season of 2018-19 to 2020-21. In the FLDs, the results revealed that seed yield (11.02 q/ha) of improved technology was higher as compared to farmers' practice (8.25 q/ha). Higher gross returns, net returns and benefit cost ratio were recorded in FLD plots as compared to farmers' practice plots. The average technology gap, extension gap and technology index were 13.98 q/ha, 2.27 q/ha and 55.93 per cent, respectively in FLD plots as compared to farmers' practice plots.

Conclusions

Each year, extension gap was lower than technology gap indicating the need to educate farmers in adoption of improved technologies. It is suggested that location-specific approaches would be needed to bridge the productivity gap of chickpea crop in the region.

Keywords: Chickpea, extension gap, front line demonstrations, technological gap, technology index

The Role Of Wicker Handicraft To Income Diversification And Inequality Mitigation In Rural Kashmir, India

M.A. Islam^{3*}, A.A. Wani¹, A.A. Gatoo¹, Shah Murtaza¹, Ummar Atta¹ and K.A. Sofi¹

¹Division of Natural Resource Management, Faculty of Forestry, Sher-e-Kashmir University of Agricultural Sciences & Technology of Kashmir, Benhama, Ganderbal-191201 (J&K), India

Extended Abstract

Wicker handicraft entrepreneurship is a unique world-famous small-scale forest-based cottage industry (Fig. 1-4) of indigenous people of Kashmir Himalaya which plays a prominent role in livelihood security, socioeconomic development, traditional handicraftsmanship and rural industrialization in Kashmir (Islam and Sheikh Shah, 2017). Over the past few years, the recognition of the extensive dependence of rural people on forest-based cottage industries have created an emergent scientific interest in entrepreneurship development on forest industries and understanding its socioeconomic determinants (Islam et al., 2020). The study investigated the economic contribution, income inequality mitigation and socioeconomic determinants of wicker handicraft to develop strategy for wicker handicraft entrepreneurship and diversify livelihoods of local people in Pulwama district of J&K UT.

Methodology

A multistage random sampling technique was administered to select the sample of 100 wicker handicraft weaving households from 20 villages in 5 blocks. Data were collected using both secondary sources and primary field survey. Primary data were collected through structured interviews, non-participant observations, focus group discussions and rapid market assessment. Secondary sources included journals, research reports, departmental records, village records, GOs and NGOs and internetd. Both descriptive and analytical statistics were used in data analysis.

Results

Results revealed that total collection of withies was 61.71 t/year @ 0.62 t/household/year; of which *Parrotia jacquemontiana* contributed maximum share (58.01%) followed by *Indigofera pulchella* (30.38%), *Salix triandra* (6.87%), *Cotoneaster baciliaris* (3.24%) and *Salix viminalis* (1.50%). The weavers manufactured a total of 43514 wicker handicrafts/year @ 435.14 handicrafts/household/year which generated a total income of ₹ 5953470/year @ ₹ 59534.70/household/year. Wicker handicraft income contributed 66.97%, whereas farm and non-farm income accounted 23.46% and 9.58% of total household income, respectively. Gini coefficient was 21.85 when wicker handicraft income was included and 53.14 when it was excluded which indicated that the wicker handicraft income has stronger equalizing effect on local income distribution. Regression analysis showed that all explanatory variables jointly accounted 81.50% ($R^2=0.815$) variation on wicker handicraft income. Among socioeconomic factors, education, family composition, housing status, subsequent occupation and gross annual income were key determinants influencing significantly ($p<0.05$) the wicker handicraft income.

Conclusion

To achieve the socioeconomic development, income diversification objectives and inequality mitigation, policy must be directed towards the rural industrialization through wicker handicraft weaving for livelihood diversification.

Keywords: Income diversification, inequality mitigation, wicker handicraft, weaving, livelihood, Kashmir, India.

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ILLUSTRATION



Fig. 1- Wicker cutting, cleaning and grading



Fig. 2- Peeling off bark from wickers



Fig. 3- Weaving of wicker handicrafts



Fig. 4- Marketing of wicker handicrafts

Efficacy of shoot bending in hasth bahar accompany plant growth growth on morphological parameters of guava crop.

Khan Jabroot*¹ J,Deepika Saxena¹ and Rahul R Rodge¹

Department of horticulture, Lovely Professional University, Phagwara, Punjab 144411

Purpose

This experiment was conducted in Guava (*Psidium guajava*) crop to analyse the effect of stooling which is also known as bending. This is a most profound operational practices performed in Maharashtra. Stooling operation is discovered by Mukherji and Mujumdar and reported by Rathor

Singh. This practice was found to increase the fruit quality in terms of several biochemical and morphological parameters. Although there are numerous means of crop regulation but this was revealed to be best amongst all. In addition to bending operation haste bahar plus application of plant growth regulators was selected to establish a relation of these operations with fruit quality.

Method

The research trial started in September and was conducted in Horticulture Farm, School of Agriculture Lovely Professional University, and Phagwara. A brief summary of materials and methodology are mentioned below, Guava crop cv. Allahabad Safeda of 6 years of age with no deformed or infestation was selected and tagged subsequently. All the cultural practices and fertilizer applications were done as per the recommendation of the PAU package of practices. The experimental study at the Main Experiment Station of LPU is situated in north-east Punjab (Phagwara), which lies in the centre of the north alluvial plain at the subtropical region. The experiment was laid out in a randomized block design. Plant growth Regulators NAA (600 ppm, 700 ppm) GA3 (100 ppm) Ethrel (3000 ppm, 2500 ppm) were selected. Shoot bending (Months) September, October and November. Time of the spray chosen was after shoot bending (emergence of flowering). The research has been carried out for hasth bahar (autumn shoot bending) and summer harvesting of guava crop. The commencement of this trial started in September 2022.

Total number of treatments = 18

Total number of replications = 3

Total number of plants= 54

Result and discussion

The different treatments were bending in September, October, November and untreated control (T7). Bending in October with resulted early emergency of new shoot let (15.0 days), flower initiation (40.33 days) and fruit set (48.33 days) from the date of bending as well as the same treatment showed maximum fruit weight (197.67 gm), fruit length (8.00 cm), fruit diameter (7.16 cm) and pulp thickness (2.20 cm). Bending in the month of October resulted in maximum C: N ratio of leaf with maximum flowering shoot lets in a branch and yield (63.67 kg/plant). So, time of bending may be standardized in the month of October or June for higher profit. The results of experiment revealed that foliar application of NAA 200 ppm recorded maximum fruit size (53.14cm²), fruit weight (138.53gm), specific gravity (1.17gm/ cm³) and minimum seed weight (5.19gm) followed by NAA 150 ppm.

Keyword Bending, NAA, Allahabad safeda., hasth bahar, etc

Pesticides In Mulberry Soil Causing Lethality And Non-Spinning In Silkworm *Bombyx Mori* L

Jyothi N.B*. and Maribashetty V.G.

Karnataka State Sericulture Research & Development Institute, Thalaghattapura, Bengaluru- 560 109, India.

Purpose

Silkworm *Bombyx mori* L with the host plant mulberry *Morus alba* is domesticated for its lustrous fiber silk. The health of silkworm is influenced by various external factors and has a direct effect on the cocoon crop quality and yield. The increase in pest population due to climate change and their shift between crops has lead to exorbitant use of pesticides and also the labour problem has lead to increased use of weedicides in agriculture, horticulture, olericulture and floriculture. Larval mortality with varied symptoms like vomiting, body swelling, shrinkage, spinning flimsy cocoons with incomplete metamorphosis into pupa was reported by the field functionaries and farmers to

our institute. Based on the survey conducted in Karnataka, India and analysis of soil, leaf and larval samples Jyothi *et al.*, (2016 and 2019) first reported that the aerial spray of pesticides to agriculture and other crops, drop to the soil and if mulberry is grown in such gardens the pesticides get translocated from soil to the leaves through root and when silkworm rearing is conducted utilizing those leaves, the larval mortality during the course of rearing with poison symptoms of vomiting, body shrinkage, convulsion, head twisting of the larva, *etc.* or in some cases, the ripe larvae are unable to spin cocoons due to swollen and shrunken body with hook shape, sometimes rectal protrusion finally leading to non-spinning or spin flimsy cocoon with incomplete metamorphosis into pupa and death. We aimed to identify those pesticides having longer half-life in soils of mulberry garden and causing toxicity with sudden knock down and non-spinning behaviour in silkworm.

Methodology

The pesticides in soil causing lethality and non-spinning behaviour were identified by comprehensive experimental method of pesticide soil application and leaf bioassay by silkworm rearing. Pesticides/weedicides commonly used by the farmers for other crops were shortlisted and selected for simulation and thus confirm the lethal/non-spinning effect of pesticide residue in soil on silkworm. The selected ten pesticides acephate, acetamiprid, carbofuran, chlorantraniliprole, chlorothalonil, dichlorvos, fipronil, imidacloprid, lambda cyhalothrin, phorate were diluted 5 ml dissolved in 3 lts of water (except Chlorantraniliprole 0.5ml/3 lts of water) individually and poured once to the soil around each plant. Three plants were maintained for each pesticide treatment and each plant was considered a replicate. Cultural practices were followed as per schedule but ploughing was not done to avoid mixing of soil and pesticide contamination to the nearby plant. Silkworm rearing was conducted periodically utilizing the mulberry leaf from the treated plants. Silkworms were reared normally upto 3rd moult with the leaf from normal mulberry garden. From fourth instar 1st day, 200 larvae/ replicate were fed continuously with the leaf harvested from the pesticide treated plants. Larval mortality during rearing with varied poison symptoms, with non-spinning and deformed pupa was recorded.

Results:

Bioassay of mulberry leaf harvested from plants grown in pesticide treated soil showed larval mortality from 17 days of post pesticide application with symptoms of vomiting of gut juice and body shrinkage. Larval mortality was high and sudden in chlorantraniliprole, imidacloprid and acetamiprid treated batches. Though the concentration used was less for chlorantraniliprole (0.5 ml/ plant) compared to other pesticides screened (5 ml/plant) it showed the highest persistence in soil.

Pesticides have a varied half-life period in soil ranging from few days to years. Pesticide half-life can be put into three groups in order to estimate persistence, *i.e.*, low (less than 16 days half-life), moderate (17 to 59 days) and high (over 60 days). In the present study, depending on the larval mortality, half life of pesticides ranged from 17 to >700 days. Phorate (17 days), carbofuran (30 days), lambda cyhalothrin (30 days), dichlorvos (30 days), acephate (30 days), fipronil (90 days), acetamiprid (90 days) and chlorothalonil (120 days) with moderate half-life period where as imidacloprid (210 days) and chlorantraniliprole (>700 days) exhibited highest half-life period (Fig. 1).

The larval mortality and non-spinning behavior in silkworm due to the leaf harvested from the pesticide applied plants depends on the concentration of pesticide. The various symptoms observed during the study are vomiting of gut juice causing brownish stain on the body, body shrinkage, raising the posterior and anterior body part forming boat shape, hyper activeness, hook shape (S

and U), body convolution, inactive, chained excreta, dried and shapeless excreta, swollen head, squeezed posterior rectum side, Rectal protrusion, head twisting and sudden death of silkworms or sub-lethal toxicity causing flimsy cocoons, incomplete metamorphosis causing deformed pupa with reduced pupal survival (Plate 2). Based on the bio-assay carried out and data collected on the lethal concentrations, symptomatology and variation of silk production, chloranthraniliprole, commonly used for agri/horticulture crops has the highest half-life period in soil in the concentration tested and is the most deleterious to silkworm. Munhoz *et al.*, (2013) have reported silkworm non-spinning and incomplete pupation by direct feeding of chloranthraniliprole.

Conclusion:

Climate change has led to the outbreak of new pests in agriculture and also mulberry. In India with an aim to increase the agri/horticulture crop yield, the unscientific use of pesticides/fungicides/weedicides has increased enormously for the past 20 years, affecting the non-targeted beneficial animals like silkworm, honey bee, fish, earthworm, birds and humans. Aerial spray of pesticides to other crops contaminates the mulberry leaf or soil due to spray drift of pesticide solutions. Intake of high pesticide dose causing sudden death and sub-lethal dose causing non-spinning in silkworm is an indication that the humans and other mammals are also target to residual effect of pesticides through fruits, vegetables, dairy, poultry and various other edible products leading to various chronic diseases.

As an immediate measure for early degradation of the pesticides the sericulturists are recommended to follow the general practices like phyto-remedial measures, Farm Yard Manure application (FYM) and green manuring of the soil, biodegradation by soil microbes and finally soil replenishment near root zone with FYM and fresh soil (Jyothi *et al.*, 2019, 2022). However, it is the need of the hour to reduce the use of pesticides for other crops. In addition, feasible soil amelioration methods for early breakdown of pesticides and thus reduce its residual effect in soil which is contaminated either by aerial spray drift from other crops to soil or from mulberry plants to soil and reduce the deleterious effect on silkworm is required.

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Effect Of Antioxidant Infused Coating On Shelf Life And Quality Of Sweet Orange

¹Mamidi Vaishnavi Reddy; ^{1*}Ab Waheed Wani; ¹Thammali Vamshi; ¹Rangu Tharun, ¹Zarina

¹Department of Horticulture, School of agriculture, Lovely Professional University, Phagwara (Punjab), India - 144411

Purpose:

Citrus occupies 23.66% of the total fruit crops area and mandarin and sweet orange are the highest grown citrus fruits in terms of area and production. The lack of suitable storage facilities and inappropriate postharvest preservation techniques forces the farmers to sell their produces immediately after picking irrespective of market demand and price which led to a negative impact on the citrus enterprises. To overcome these crises various postharvest treatments were evolved i.e. wax coatings, fungicide treatments, edible coatings such as CMC (carboxymethylcellulose), aloe vera gel, tragacanth gum and cellulose coatings. The aim to identify the application of CMC

(carboxymethylcellulose) along with essential oil (clove oil) in combination divided into seven treatments containing three replications in each at different concentrations T₁ (control) , T₂ (cmc + clove oil (0.5%)), T₃ (cmc + clove oil (1.0%)) , T₄ (cmc + clove oil (1.5%)), T₅ (cmc + clove oil (2.0%)) T₆ (cmc + clove oil (2.5%)) T₇ (cmc + clove oil (3.0%)) for the control of economically important postharvest shelf life and maintenance of fruit quality in sweet orange fruits.

Methods:

Fresh nucellar (Mosambi) sweet orange fruits of uniform shape and size with no bruises were procured from an ideal sweet orange orchard. Fruits were washed thoroughly under tap water and then dried under fan. The solutions of CMC and essential oil are thoroughly prepared. After complete drying fruits were treated first with CMC and then in essential oil and were spread into seven treatments and kept for observation. Observations have been recorded for every five day interval each.

Results:

A qualitative nature of resistance has been observed in treatment 7 i.e. (CMC + clove oil (3.0%)). Increment in TSS, TA, ascorbic acid , organoleptic parameters, antioxidant, phenol and ash content were observed. Hence it is suggested that the sweet orange fruits treated with CMC and clove oil (3.0%) enhances shelf life and quality of fruits.

Conclusions:

The resistant accessions identified here can be suggested as novel approach to improve their marketing shelf life and quality and also reduce the chemical usage in postharvest treatments. Finally it is recommended that CMC (carboxymethylcellulose infused with clove essential) improves shelf life and quality to optimize both cold storage room and refrigerated container for citrus fruit shipping

Keywords: Shelf life; Postharvest; Sweet orange; Coating.

The Silent Pandemic: Examining the Impact of COVID-19 on the Mental Health of Agricultural Farmers

KM. Pratima¹ Dr. Suman Audichya¹ ANUSHKA TIWARI²

¹ *Human Development and Family Studies, M.P.U.A.T., Udaipur, 313001 (Rajasthan), India*

² *Resource Management and Consumer Science, M.P.U.A.T., Udaipur, 313001 (Rajasthan), India*

Purpose

The purpose of the study on the Impact of COVID-19 on the Mental Health of Agricultural Farmers is to examine the effects of the pandemic on the mental health of farmers in the agricultural sector. The study aims to identify the psychological impact of COVID-19 on farmers, including changes in anxiety, depression, and stress levels.

Methods

A quantitative survey design will be used. To gather information on agricultural farmers' mental health state and the effects of COVID-19 on their mental health, a survey will be administered to them. The inclusion criteria will be farmers who have been involved in agriculture for at least one year and are aged 18 years above. The sample size will be determined using a power analysis, and a sample size of at least 300 participants will be targeted.

Results

The finding that 109.5% of the farmers reported feeling more stressed than usual suggests that some farmers may have experienced stress levels that exceeded their usual baseline levels. A study conducted in India (UP) found that male farmers experienced higher levels of anxiety and depression during the pandemic, our result value shows that the average value 72.02 of male

farmers reporting moderate to severe anxiety symptoms. A correlation analysis was conducted to explore the relationship between the impact of COVID-19 on mental health and the extent to which farmers were affected, the r value got positive correlation between male and female farmers.

Conclusion

Farmers have also experienced difficulties because of their lack of access to mental health care, social isolation, and viral fear. The study finds that the COVID-19 epidemic has had a positive effect on agricultural farmers' mental health, stressing the need for more resources and support to address their particular needs at this trying period.

Investigating the Occupational Health of Sugarcane Harvesters in Gonda District

Anushka Tiwari* Suman Singh , Hemu Rathore, Km. Pratima

Resource Management and Consumer Science, M.P.U.A.T., Udaipur, 313001 (Rajasthan), India.

Human Development and Family Studies, M.P.U.A.T., Udaipur, 313001 (Rajasthan), India.

Abstract

In Uttar Pradesh, sugarcane harvesting is a common practice. Most farmers experience minor cuts, wounds, lacerations, sometimes significant cuts or even finger amputations when harvesting. This study aims to find the health status of sugarcane harvesters during the sugarcane harvesting time. Survey method was applied for collecting the primary data. Total sample size was 86 for both male and female. Ninety seven percent of harvesters had dry itchy hands, 79% had backache, while approximately 72% of them had headache. Neck joint, shoulder joint, wrist joint, Upper and lower back joint and knee joints pain were mostly observed under musculoskeletal pain. 23.2% harvesters were not used personal protective measures. Harvesters faces lots of problem during sugarcane harvesting i.e., musculoskeletal pain, itchy dry hands, eye related issues and minor cuts problems.

Keywords- Occupational health, musculoskeletal injury, harvesters.

Introduction-

The harvesting of sugarcane requires working long hours in hot, humid circumstances and is physically difficult and dangerous. Numerous health issues, such as musculoskeletal disorders, respiratory conditions, and heat stress, are linked to this type of work.

In addition, sugarcane workers are also at risk of exposure to agrochemicals, such as pesticides and fertilizers, which can have negative health effects. These chemicals can cause skin irritation, eye damage, and respiratory problems, among other issues. Because harvesters' repetitive postures harmed their muscles, they suffered from adverse occupational health effects².

There are a number of factors that can affect the occupational health condition of sugarcane harvesters in the Gonda district, including the type of tools and equipment used, the accessibility of safety precautions, and the frequency of health risks in the area.

To gain a better understanding of the occupational health status of sugarcane harvesters in Gonda district, to explore the health risks connected to this kind of job and assess the effectiveness of current safety rules and protective measures, a thorough study could be carried out. Majority of workers faced hazards in their workplaces due to lack of safety measures and unawareness².

Objectives-

To find out the health status of and problems faced by selected sugarcane harvesters.

Assumptions- The researcher assumed that-

The sugarcane harvesters will provide the response.

The sugarcane harvesters will have some short of health issues due to heavy post-harvest activity.

Delimitation-

The study was delimited to only the sugarcane harvesters, Gonda district.

The study was delimited to sugarcane harvesters who were willing to participate in the study.

The study was delimited to sugarcane harvesters who are present at the time of data collection.

Methods-

The survey method was conducted at Gonda district. Total sample size was 86 in which both male and female respondents were selected. Ashokpur village was selected from Tarabganj block for collecting the data. In which 43 were male and other 43 were male respondent. Convenient sampling method was used. Health issues were asked by researcher which occurred during sugarcane harvesting. A person engaged in cutting, tying up, and putting sugarcane into a vehicle was referred to as a sugarcane harvester.

Results and findings-

Table 1. Demographic profile of harvesters involved in post-harvest activity of Sugarcane crop. (n=86)

S.No.	Characteristics	Frequency (%)
1.	Age	
	15- 25 years	36 (41.8)
	25-35 years	40 (46.5)
	>35 years	10 (11.6)
2.	Gender	
	Male	32 (37.2)
	Female	54 (62.7)
3.	Education	
	Literate	39 (45.3)
	Illiterate	47 (54.6)
4.	Occupation	
	Farmer	37 (43)
	Student	23 (26.7)
	laborer	26 (30.2)

Total 86 harvesters were selected for this study. In which (46.5%) were 25- 53 age group and only (11.6%) harvesters were belonged to 35 age group. It is observed that majority of females were involved (62.2%) while (37.2%) males were engaged in post-harvest activity of sugarcane crop. Illiterate population was (54.6%).

Table1 presents the occupation of harvesters it shows 43% population was farmer whereas only 26.7% population was found in student group.

Table 2. Occupational health status of farmers during post-harvest activity of sugarcane crop. (n=86)

S.No.	Characteristics	Frequency (%)
1.	Problem with eyes	100%

	Dust in eyes	30 (34.8)
	Small stem's particles	42 (48.8)
	Crop leaf particles	14 (16.2)
2.	Allergic status	100%
	Itching problem in skin	36 (41.8)
	Itching problem in eyes	26 (30.2)
	Dry cough	2 (2.3)
	Watery eyes	22 (25.5)
3.	Itchy dry hand	84(97.6)
4.	Headache	62 (72.0)
5.	Backache	68 (79.0)
6.	Nose bleeding	8 (9.3)
7.	Severe cuts in body parts	6 (6.9)

The total 86 harvesters were including in this study. Among them 97.6 were suffering from itchy dry hand, backache issue was found 79%, headache was seen 72%. Table no. 2 presented that harvester were faced small stem particles 48.8%, 34.8% dust in eyes, 16.2 % was seen under crop leaf particles which effects eyes problem badly.

Occupational health hazards have deleterious effect on backache (42%), joints or muscles problems, fifty two percent and vision problems (81%) because of unavailability of PPE kit¹. Harvesters were also suffered from allergic issues like skin itching (41.8%), dry cough (2.3%), and 25.5 % was seen under watery eye issues.

Table 3. Musculoskeletal joints pain during harvesting. (n=86)

S. No.	Characteristics	Frequency (%)
1.	Upper joint	84 (97.6)
2.	Knee joint	79 (91.8)
3.	Neck joint	78 (90.6)
4.	Lower back joint	71 (82.5)
5.	Shoulder joint	66 (76.7)
6.	Elbow joint	61 (70.9)
7.	Wrist joint	52 (60.4)

Almost all the sugarcane harvesters had musculoskeletal issues in their body. Upper joint pain was the most one prevalent among (97.6 %) of the sugarcane harvesters while (91.8%) was found in Knee joint (90.6%) was seen in Neck joint pain, followed by lower back joint (82.5%), shoulder joint (76.7%). In elbow joint (70.9%) and wrist Joint (60.4%) was less involved in pain.

Table 4. PPE measured used by harvesters during sugarcane crop. (n=86)

S.No.	Types of PPE	Frequency (%)
1.	Gloves	6 (6.9)
2.	Mask	2 (2.3)
3.	Protective cloth	58 (67.4)
4.	None	20 (23.2)

Table 4. highlighted the personal protective measures used by harvesters during sugarcane harvesting. Majority of harvesters (67.4%) used protective cloth as a personal protective measure. It was found that only (6.3%) harvesters used gloves during harvesting whereas (2.3%) were used mask. (23.2%) harvesters did not used any sort of protective measures.

DISCUSSION-

In this investigation, it was discovered that sugarcane harvesters frequently suffered from several occupational health conditions. Most of the problems and pain was found under in lower back joints, backache, headache, allergic conditions, musculoskeletal pains and nose bleeding.

During the harvesting time two main body postures was used by harvesters in which bending and sitting was noted. Due to the repetitive, static and continuous postures for long hours effects lower back joints pain of the harvesters. While cutting, pulling, and loading sugarcane onto the vehicle, they were required to bend their bodies numerous times. Because they frequently result in productive coughing, such motions put the average sugarcane harvester at risk of developing musculoskeletal pains.

Conclusion-

The result of the study highlighted that overall occupational health consequences are amongst the common consequences is most of the occupation. Foreign body in the eye, allergic conditions and musculoskeletal pain were the most prevalent occupational health consequences during the work.

Acknowledgement

We sincerely appreciate Dr. Suman Singh (Professor and Senior Scientist) advice and oversight as we conducted the current research work. We are grateful to Dr. Hemu Rathore, College of Community and Applied Science (Professor and HOD, Resource Management and Consumer Science) for her constant support and inspiration.

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Management of chickpea pod borer, *Helicoverpa armigera* (Hubner) by evaluating different IPM modules

Amogha, Usha, G. K. Sujayanand, Meenakshi Arya, Anshuman Singh, M. Soniya Devi and V.K. Mishra

Department of Entomology College of Agriculture, Rani Lakshmi Bai Central Agricultural University, Jhansi-284 003

Purpose:

Chickpea (*Cicer arietinum* L.) is the most important *Rabi* season legume crop which is grown all over the world. India is the leading producer of chickpeas and accounts for 70% of global production. Chickpea is known to be attacked by a huge number of pests. Among them, pod borer *Helicoverpa armigera* (Hubner) (Noctuidae: Lepidoptera) is considered a major pest and responsible for the higher yield loss. At present, crop protection in the agricultural system mainly

relies on the use of agrochemicals. But continuous use of insecticides led to the development of resistance in insects, resurgence, and also causes environmental pollution. To avoid sole dependence on pesticides, other methods like the use of biopesticides, trap crop, botanicals, and a combination of them were used for the management of gram pod borer. With this aim in view, the study was conducted in the Agricultural Research farm of Rani Lakshmi Bai Central Agricultural University, Jhansi during the *Rabi* season 2021-22 on sustainable approach viz., integrated pest management modules for management of pod borer, *H. armigera*.

Methods:

The chickpea variety RVG 202 was sown in a 5×5 m² plot size for each module under Randomized Block Design with three replications and (30×15) cm spacing was maintained. Eight IPM modules were evaluated including untreated control. The observations on larval populations were taken on 5 randomly selected plants from each plot 1 day before spray and 1 day, 7 days, and 14 days after spraying of insecticides. Pod damage was also assessed. The benefit-cost ratio was calculated for each treatment.

Results:

Among the different tested management modules, Module-2 comprising of Spinosad 45% SC + Datura leaf extract 25% proved to be most effective in minimizing the larval population (0.69 larvae/5 plants) along with that the lowest percent pod damage (6.91%), the highest yield (1.57 t/ha) and the highest net profit (Rs. 32, 888 /ha) were also obtained. However, the highest incremental benefit-cost ratio was recorded in Module-1 (NSKE 5% + Marigold) (6.32: 1) due to less pesticide application and more return obtained from Marigold.

Keywords: *Helicovera armigera*, Chickpea, IPM modules, B-C ratio, Spinosad.

Impact of Climate Change on Coastal Aquaculture**Sacratees. J and Athira Raveendran**

Department of Economics, Manonmaniam Sundaranar University, Tirunelveli -627 012 Tamil Nadu, INDIA

Fisheries and aquaculture have been identified as important sources of food, nutrition, income and livelihoods for hundreds of millions of people all around the world. Climate change is one of the most important factors that is expected to have serious environmental consequences on economic and social effects on human survival. Climate variability will create tremendous challenges to agriculture, aquaculture, fisheries and other sectors in the economy. Therefore, the issue of climate change is currently high on the global political agenda. This paper addresses the climate change impact on coastal regions of Thoothukudi and Ramanathapuram (Gulf of Mannar) in Tamil Nadu where the unusual threats faced due to natural disturbances such as cyclonic storms, temperature, and water and soil pollution causing damage to aqua farms. Therefore, in order to reiterate the concept of creating the Gulf of Manner Biosphere Reserve with a marine National Park to encourage and protect the marine resources so as to utilize endangered coastal species in a sustainable way to promote socio-economic benefits of indigenous people of those regions. The overall objective of the research is to assess the climate change impacts on selected coastal areas of Thoothukudi and Ramanathapuram Districts and to estimate social, economic and environmental attributes towards climate change impacts.

Methods

This study is based on both primary and secondary data sources. The primary data were collected from the prawn cultivators and owners of the aqua farms, farm agriculturists and land owners

nearer to the aqua farms and workers in aquaculture through interview schedules. The secondary data were collected from all government records and official websites. Besides, the study has used hedonic pricing method to estimate the opportunity cost between the alternative uses of land and estimate the implicit price of the land that has been changed due to environmental values and this has been estimated through hedonic pricing method model.

Results

The study based on fisher's perception on different attributes in the selected areas indicated that climate change has mostly impacted fishery followed by economic and environmental damages in the two districts. Another attribute indicates that the fishery was impacted mostly by species composition and catch. Fish catch has decreased drastically over the years and effort has increased fairly. According to fishers' coastal fishes have migrated to open sea and there is a shift in spawning season of major fishes along the coast due to climate change. Due to extreme weather events, there is considerable damage to fish stock. Another major threat in the coastal areas is unprecedented discharge of industrial pollution including heavy metals in the shore waters causing huge damage to the marine species. The aquaculture waste is another major threat that can adversely affect wild population of fish. The farming systems, farm size, the prior land use of farms, source of water, clustering of farms, interaction between extensive and semi-intensive farms, operation of farms by owners/managers, pond effluent management, feeds etc. were considered as factors responsible for environmental problems in the shrimp farms. Concentration of shrimp farms in a few pockets, intensification of farming, mushrooming of farms, adoption of unscientific farming practices, indirect influence of success achieved in neighboring countries are wrong notions of farmers about higher profitability of intensive farming. Contrary to popular perception, a study conducted by the Central Institute of Fisheries Education (CIFE) states that shrimp farming does better than harm. Aquaculture wastes are rich in nutrients and can be utilized by integration with other aquaculture or agriculture production systems. It is important to mention at this juncture that farm levels mitigation measures can assure environmental quality to a large extent but social impacts like resources use conflicts, equity issues, Stalinization and access needs strict government regulations.

Conclusion

Climate change is predicted to have a wide range of impacts on fisheries and those who depend on them. The present study was aimed to assess the vulnerability of climate change impacts on coastal aquaculture, environmental issues like water and soil test, economic, social and development initiatives to be taken to combat selected coastal areas in Thoothukudi and Ramanathapuram districts of Tamil Nadu. The study revealed that fishery is the most affected industry due to climate change. Fishers perceive that the fishery and economic parameters are of importance in the climate change adaptation and mitigation plan. The aquaculture industry is highly prone to face severe damage due to erratic weather and climate change impacts. There is a need to provide adequate training, disaster preparedness and planning to battle from the climate changes impacts. The farmer needs to be assisted by scientific research and technology development to find solutions that will allow them to adapt to the predicted future climate change. A very strong focus on building general adaptive capacity can help the poor shrimp aquaculture communities to cope with new challenges.

Keywords: Climate Change, Aquaculture, extreme weather, sea level rise and economic loss.

Emergence of new plant diseases and Significance of plant growth promoting microorganisms for disease management under changing climatic scenario

Gururaj Sunkad and Meghana S. Patil

Purpose

Climate change is predicted to have a direct impact on the occurrence and severity of diseases in crops, which will have a serious impact on our food security. Climate change will result in rise in temperature and carbon dioxide levels and will also have a varied effect on moisture. In many cases, temperature increases are predicted to lead to the geographic expansion of pathogen and vector distributions, bringing pathogens into contact with more potential hosts and providing new opportunities for pathogen hybridization. Apart from this, many new diseases have reported and also minor diseases have become major diseases in recent years. Plant diseases are responsible for the loss of at least 10% of global food production, representing a threat to food security. The prevention of diseases mainly dependent on agro-chemicals especially from the past few decades. Despite the great effectiveness and ease of utilization of chemicals products, their use or misuse has led to hazardous effects to environment. Some microorganisms, the bio-control agents are able to colonize the soil surrounding plant roots, the rhizosphere, making them come under the influence of plant roots.

Methods

Plant Growth Promoting Microorganisms (PGPMs) generally refers to a group of soil and rhizosphere free-living bacteria and fungi colonizing roots in a competitive environment and exerting a beneficial effect on plant growth as well as disease management. PGPM play key role not only in transforming nutrients in the soil but also giving protection against plant diseases. The beneficial effect of PGPM on plant growth involves the ability to act as phyto-stimulators or biofertilizers. PGPM could enhance crop yield through nutrient uptake and plant growth regulators. PGPM could also act as bio-control agents by the production of antibiotics and triggering induced local or systemic resistance. The exact mechanism by which PGPR stimulate plant growth is not clearly established, although several hypotheses such as production of phytohormones, suppression of deleterious organisms, HCN and siderophore production, activation of phosphate solubilization, volatile compound production and promotion of the mineral nutrient uptake and plant growth promotion are usually believed to be involved.

Results

The studies conducted on groundnut, chickpea and pigeon pea diseases indicated that PGPMs can be used for plant growth promotion and management of diseases in these crops. The indigenous PGPM isolates of Bacillus, Trichoderma and Pseudomonas fluorescens showed percent inhibition of pathogens. Apart from this, the isolates were positive for KOH test, catalase test, starch hydrolysis, urease test, casein hydrolysis, gelatin liquefaction, indole and H₂S test. The shelf life of was maximum in talc and least in rice bran up to 150 days. The results also indicated the the PGPMs also able to produce bio-active compounds. The GC-M S/M S analysis of ethyl acetate extract of Trichoderma showed the presence bioactive compounds which are reported to process antimicrobial property. The Germination per cent, shoot length, root length and seedling vigour index.

Conclusions

Hence, there is a lot of scope for PGPMs in agriculture in general and plant disease management in particular. Sustainable agriculture based on environmentally-friendly methods, tends to use PGPMs as tool that could as a by-product reduce the use of chemicals. There is a great need for eco-friendly management of plant diseases through bio-agents such as PGPMs in worldwide.

Biotechnological approaches for *in vitro* propagation of some potential medicinal plants**Iram siddique***Plant Biotechnology Laboratory, Department of Botany, Aligarh Muslim University, Aligarh 202 002, U.P., India***Abstract**

Medicinal plants have been used since the inception of civilization but human influence on natural ecosystems, over-exploitation, habitat destruction and unsustainable harvesting coupled with illegal trade practices have driven many medicinal plant species to the brink of extinction. Biotechnological approaches supports to *ex situ* conservation programmes, besides complementing conventional methods, have the potential to broaden the genetic base in species demanding high priority. Tissue culture techniques have play a vital role for large scale production of either genetically true to type genotypes of superior planting material or by producing planting stock for endangered and commercial species where limitation is in their large scale propagation. The objectives of the present study was to develop an efficient and rapid *in vitro* propagation protocols of two medicinally and aromatically important plants species viz., *Mucuna pruriens* and *Ocimum basilicum* using tissue culture techniques. Changes in photosynthetic parameters and antioxidative enzymes were also measured during the *ex vitro* acclimatization of micropropagated plantlets.

Methodology

Different explants viz., cotyledonary node, nodal segment and shoot tip were excised either from aseptic seedlings or mature plants. After sterilization, explants were cultured on Murashige and Skoog (MS) medium supplemented with different concentrations of TDZ, BA, Kin, and 2-iP either singly or in combination with NAA or IAA. Synthetic seeds were also produced by the encapsulation of nodal segments in calcium alginate hydrogel containing MS medium to investigate their *in vitro* conversion potential. Healthy and well grown regenerated microshoots were rooted efficiently on a medium containing various concentration of different auxins (IAA, IBA & NAA). After hardening process, well developed plantlets were transferred successfully to the greenhouse and finally to field.

Result

Direct multiple shoot formation in *M. pruriens* was achieved from cotyledonary node and nodal segment explants using cytokinins (BA, Kin, 2-iP and TDZ) either alone or in combination with auxins (IAA and NAA). Maximum frequency of shoot regeneration was obtained on half strength MS medium supplemented with BA (5.0 μM) and NAA (0.5 μM) at pH 5.8 from nodal segment. Half strength MS medium supplemented with IBA (2.0 μM) showed best rhizogenesis in *M. pruriens*. Direct shoot regeneration in *O. basilicum* was achieved through mature explants (nodal and shoot tip) using cytokinins singly or in combination with auxins. Maximum shoot multiplication was recorded in *O. basilicum* on half strength MS medium supplemented with BA (2.5 μM) + IAA (0.5 μM) from nodal explants at pH 5.8. Nodal explants of both *M. pruriens* and *O. basilicum* pretreated with 50 μM TDZ for 8 days followed by their transfer to MS basal medium devoid of TDZ was found effective for multiple shoot induction. Rooting was best induced in *O. basilicum* on MS medium amended with 1.0 μM IBA.

Conclusion

To conclude, I could achieve success in developing an efficient, replicable and complete micropropagation protocols for *in vitro* regeneration of two valuable medicinal plants, *M. pruriens* and *O. basilicum*. The protocols developed could provide a rapid technique for mass propagation

and multiplication of these two potential medicinal plants and can further be used in crop improvement using genetic transformation technology.

Effect of Various / Different Mulches on Flowering Characters of Marigold (*Tagetes erecta* L.)

Maqsood Ali Wagan,

Sindh Agriculture University Tando Jam, Sindh, Pakistan

Purpose

In the present study, a field experiment was conducted to study the Effect of different mulches on flowering characters of marigold. A field experiment was performed in sindh agriculture university tando jam, sindh, Pakistan, during the period from October 2021 to march 2022 to quantify the effect of different mulches on flowering characters of marigold flowers.

Methods

A field experiment was conducted to study the Effect of various/ different mulches on flowering characters of marigold. A field experiment was performed in sindh agriculture university tando jam, sindh, Pakistan, during the period from October 2021 to march 2022 to quantify the effect of different mulches on flowering characters of marigold. The region is underneath warm and humid area with lateritic soil type. The test turned into laid out in randomized block layout and 5 exceptional mulching remedies viz; control (no mulch), black polyethylene mulch, dry grass, paddy straw, and banana leaves. The flat beds of the dimensions 4.2 x 1.2 m had been prepared. The seedlings had been transplanted at the spacing of 30 x 45 cm. The mulches (dry grass, paddy straw, and banana leaves.) changed into laid between the two rows of seedlings in one of this way that it covers the region among two rows. The polythene mulch films of every coloration i.e. Black reduce in size of 4.2 x 1.2 m and laid among rows of seedlings in this kind of manner that it cover all of the location among two rows. The each fringe of polythene stripe has been buried at either aspect of flat beds to guard the movie towards harm through wind. The encouraged cultural practices were followed to raise the crop.

Results

Plants Height, The longest plant (36.1 cm) were obtained from the T2 (black polythene mulch) respectively. However, the shortest plant (23.20 cm,) was recorded from the T1 (control). Number of Leaves per Plants, The greatest number of leaves per plant was recorded from T2 (52.80) (black polythene mulch) while the minimum number of leaves from the T1 (35.11). Numbers of the Branches/Plant, The greatest number of the branches per plant of marigold (34.88) was obtained from T2 (black polythene mulch). The minimum number of branches per plant of marigold (22.55) was observed from T1 (control). The notably early initiation of flowering (35.00) become located in remedy T2 (black polythene mulch). The delayed initiation of flower bud (49.10) turned into discovered in treatment T1 (manipulate). Notably maximum range of days (50.13) turned into required for initiation of flowering in T1 (manage). The earliness in days to flower initiation beneath black polythene mulching may be because of better boom of flora, as end result of excessive soil temperature and excessive soil moisture which helped in profuse and early initiation of bud and flower underneath black polythene mulching. The significantly lowest variety of days required for 70% flowering (47.04 days) and the longest period of flowering (69.50 days) have been additionally taken from treatment T2 (black polythene mulch). Vegetation inside the T2 (black polythene mulch) treatment had the appreciably highest flower diameter (8.00 cm), highest fresh weight (13.50 g/flower) and dry flower weight (3.00 g/flower).

Conclusions

The conclusions of this experiment is that the very well results were obtained from the T2 (black polythene mulch) respectively. However, lowest results of this experiment were recorded from the T1 (control).so that it is recommended that use of black polyethylene mulch is beneficial for the marigold flower.

Keywords:Mulching effects, Marigold Flowering Character and importance

Effect of Nano- ZnO and FeO on growth, yield, quality and shelf life of Strawberry (Fragaria × ananassa Duch.) cv. Winter Dawn under open and protected conditions.

Lakhwinder Singh* Ramesh kumar sadawarti¹, Shaifali and Rahul R Rodge

Department of Horticulture, Lovely Professional University, Phagwara, Punjab (144-411), India.

Abstract

Purpose: This experiment was conducted in Strawberry (Fragaria × ananassa Duch.) crop to analyse the effect of Nano fertilizers (ZnO and FeO) with different concentrations. Nano-technology is an integrated manner to account for potential downfalls and take full advantage of the opportunities and synergies the use of nano-fertilizers may provide for the sustainable future. The future development and adoption of these molecules as an answer for increasing food production with higher nutrient efficiency will need to balance economic and environmental costs of production with the potential reduction of environmental impact and yield increases. The need to validate the pros and cons of nanofertilizers under representative field conditions for strawberry crop to address the questions arising from farmers also remains as a pending task before the widespread adoption of this technology.

Method

The research trail started in the month November and conducted in Horticulture Farm, School of Agriculture, Lovely Professional University (Phagwara). A brief summary of materials and methodology are mentioned below, The plants of Strawberry Cv. Winter Dawn were transplanted by 7th and 8th of November 2022 under protected and open field condition. Before transplanting of plants, field was prepared well. The vermicompost was properly mixed with the soil before making beds under both the condition protected and open field. The experimental study at the Main Experiment Station of LPU is situated in north-east Punjab (Phagwara), which lies in the centre of the north alluvial plain at the subtropical region. The experiment was laid out in a randomized block design. Application of nano-fertilizers ZnO and FeO, T₀ Control, T₁ 50ppm ZnO, T₂ 100ppm ZnO, T₃ 150ppm ZnO, T₄ 50ppm FeO, T₅ 100ppm FeO, T₆ 150ppm FeO, T₇ 50 ppm ZnO + 50 ppm FeO, T₈ 50 ppm ZnO + 100 ppm FeO, T₉ 50 ppm ZnO + 150 ppm FeO, T₁₀ 100 ppm ZnO + 50 ppm FeO, T₁₁ 100 ppm ZnO + 100 ppm FeO, T₁₂ 100 ppm ZnO + 150 ppm FeO, T₁₃ 150 ppm ZnO + 50 ppm FeO, T₁₄ 150 ppm ZnO + 100 ppm FeO, T₁₅ 150 ppm ZnO + 150 ppm FeO. The commencement of this trial started in November 2022.

Crop = Strawberry

Variety = Winter Dawn

Total number of treatments = 16

Total number of replications = 3

Row to row distance = 45cm

Plant to plant distance = 30 cm

Environment Conditions = Open and polytunnel

Result

The different treatments were applied to the crop in the first fortnight of December month, 40 days after transplanting of the strawberry plants. Among all the treatments the T₁₅ (150 ppm ZnO + 150 ppm FeO) shows the best results regarding the vegetative growth, yield and quality along with the shelf life of fruits. Plant height, plant spread, number regarding leaves, the leaf area were significantly influenced by various at all successive stages of growth. Under protected condition, maximum number of leaves (15.00) and leaf area (73.11) cm², chlorophyll content (55.47), petiole length (9.41), plant height (12.24cm), stem girth (26.62mm), plant spreading (22.99), were recorded in T₁₅ (150 ppm ZnO + 150 ppm FeO). On the other side, under open field condition, maximum number of leaves (14.00), leaf area (74.86) cm², chlorophyll content (53.40), petiole length (9.34 mm), plant height (12.32 cm), stem girth (24.69 mm), plant spread (23.08), were recorded in T₁₅ (150 ppm ZnO + 150 ppm FeO). The earliest flowering and number of flowers plant⁻¹ were beneficially increased by the various treatments. Under protected field, Earliest flowering (46.00) and maximum number of flowers per plant (11.00 at 80 days) was recorded in T₁₅ (150 ppm ZnO + 150 ppm FeO). Under open field, Earliest flowering (45.67) and maximum number regarding the flowers per plant (12.33 at 80 days) was recorded in T₁₅ (150 ppm ZnO + 150 ppm FeO). Number of fruits plant⁻¹, diameter of the fruits, fruit weight including the fruit length were positively increased by the various treatments at all successive stage of yield attributes. Under protected field, Maximum number of fruit per plant (9.67 at 95 days), fruit weight (11.91 gm) and fruit length (4.79 cm) were recorded in T₁₅ (150 ppm ZnO + 150 ppm FeO). Under open field condition, Maximum number of fruit per plant (9.67 at 95 days), fruit weight (12.09 gm) and fruit length (5.01 cm) were recorded in T₁₅ (150 ppm ZnO + 150 ppm FeO). As far as the quality related to fruit is concerned, application having different treatments enhanced the fruit quality parameters Under protected condition, maximum fruit TSS (6.98°brix), ascorbic acid (52.29), acidity (0.72%), total sugars (7.93%). Under open field condition, maximum fruit TSS (6.95°brix), ascorbic acid (52.48), acidity (0.72%), total sugars (7.50%).

Conclusion: It can be concluded positively that treatment T₁₅ (150 ppm ZnO + 150 ppm FeO) was found the best in terms of growth, quality and yield attributes of the strawberry cv. Winter Dawn, Under both protected as well as open field condition.

Keyword: Nano technology, nano-fertilizers, strawberry, ZnO, FeO, winterDawn etc.

Crop phenology-based application of insecticides for the management of pod borer complex of pigeonpea.

Pradnya S. Kadam* and P. B. Chikte

Pulses Research Unit, Dr. Panjabrao Deshmukh Krishi Vidyapeeth Akola, Maharashtra 444104(India).

Introduction

The economic losses in pigeonpea occurs at the reproductive stage. Pigeonpea pod borer complex comprising of pigeonpea pod borer, tur plume moth and tur pod fly are the major constraints for attainment of higher productivity of pigeonpea.

Integrated pest management includes various tools which includes, cultural, physical, mechanical, biological and lastly chemical control. As the pod borer are internal feeder it is very difficult to manage these pests, hence, application of insecticides will be better alternative to take up plant protection measures. Two-three application of insecticides in reproductive phase of crop is recommended for efficient management of pod borer complex of pigeonpea. Thus application of

insecticides at 50 per cent flowering, 15 days after first application and 20 days after second application will be helpful to manage the incidence of pod borer complex of pigeonpea.

With the increase in market price, there is an inclination of the farmers for utilization of newer molecules with different mode of actions available in the market for the management of pod borer complex of pigeonpea. Thus, there is a need to evaluate the efficacy of newer insecticides based on application of module for economic production of pigeonpea.

Objectives:

1. To formulate management strategy for the pod borer complex of
2. To estimate the efficacy and economics (ICBR) of newer insecticides against pod borer complex of pigeonpea.

Methodology:

i) Year and Location	:	Multilocation trial conducted at 2 locations Pulses Research Unit, Akola KVK, Wardha 2020-21 and 2021-22 (2 Years)		
ii) Design	:	RBD		
iii) Replication	:	3		
iv) Modules	:	Seven		
v) Variety	:	PKV TARA		
Treatments/modules details				
. Target	Pod Borer	Pod Borer	Pod fly	
Treatment/ Phenology	At 50 per cent flowering	15 days after first application	20 days after second application	
M ₁	Thiodicarb 75 WP (1000 g/ha)	Chlorantraniliprole 18.5 SC (150 ml/ha)	Lambda-cyhalothrin 5 EC (500 ml/ha)	
M ₂	Thiodicarb 75 WP (1000 g/ha)	Flubendiamide 39.35 SC (100 ml/ha)	Lambda-cyhalothrin 5 EC (500 ml/ha)	
M ₃	Thiodicarb 75 WP (1000 g/ha)	Emamectin benzoate 5 SG (220 g/ha)	Quinalphos 25 EC (1400 ml/ha)	
M ₄	Ethion 50 EC (1500 ml/ha)	Chlorantraniliprole 18.5 SC (150 ml/ha)	Quinalphos 25 EC (1400 ml/ha)	
M ₅	Ethion 50 EC (1500 ml/ha)	Flubendiamide 39.35 SC (100 ml/ha)	Lambda-cyhalothrin 5 EC (500 ml/ha)	
M ₆	Ethion 50 EC (1500 ml/ha)	Emamectin benzoate 5 SG (220 g/ha)	Lambda-cyhalothrin 5 EC (500 ml/ha)	
M ₇	Untreated control			

The number of *Helicoverpa* and plume moth larva on five plants was recorded at 7 and 14 days after first and second spray. Pod fly damage in 50 randomly selected pods was recorded at 7 and 14 days after third application. The total number of pods from five selected plants at maturity (harvest) and total affected pods by lepidopteran pod borers (*Helicoverpa* and plume moth) and pod fly were recorded to estimate per cent pod damage and grain damage. The yield of plot per treatment was also recorded to estimate the efficacy and economics of application of newer insecticides

Results

Effect of different insecticide modules on larval population of pod borer complex of pigeonpea (pooled 2020-21 and 2021-22)

The data regarding effect of different treatments on larval population of pod borer on pigeonpea at 50 per cent flowering at 7 days after treatment indicated that, lowest population of *H. armigera* recorded in module 1 and was at par with module 2 and recorded 0.14 and 0.15 larva per plant, respectively. Both these modules found statistically superior over rest of the treatment.

Effect of different insecticide modules at pod filling stage on *H. armigera* larvae at 7 days after treatment, indicated that the most effective treatment module in larval reduction found was in module 1, recorded 0.15 larva per plant. Influence of different insecticide modules at 14 days after treatment at pod filling stage on *H. armigera* revealed that, the most effective treatment module in terms of larval reduction was found in module 1, which recorded 0.38 larva per plant followed by module 2 with larval population of 0.45 per plant. The untreated control recorded highest larval population of 2.58 larvae per plant.

The lowest larval abundance of plume moth was recorded in both module 1 and module 2 *i.e.* 0.18 after 7 days of treatment. The next effective module was module 3 which recorded the larval population of plume moth *i.e.* 0.25 larva per plant. All these three modules found significantly superior over rest of the treatments and found at par with each other. Similar trend was observed in case of pod filling stage.

The larval population of pod fly after 7 DAT and 14DAT at 50 per cent flowering and at pod filling stage. The treatment module 1 found significantly superior over rest of the modules and recorded lowest larval population of pod fly at 7DAT and 14 DAT *i.e.* 2.25 and 2.50 larvae, respectively. The next effective module was module 2 which recorded 3.67 and 3.83 larvae after 7DAT and 14DAT, respectively.

Effect of different insecticide modules on per cent pod damage by pod borer complex and grain damage by pod fly in pigeonpea (pooled 2020-21 and 2021-22)

The lowest pod damage of (lepidopteran pest) was recorded in module 1 (with 3.58 per cent which was at par with the module 2 which recorded the 4.70 per cent pod damage due to lepidopteran pests. Similar findings were reported by Tagger *et al.*, (2021) who reported that application of chlorantraniliprole followed by flubendamide registered significantly lowest pest population and cumulative pod damage.

The similar trend was observed in data recorded in case of per cent pod damage and grain damage by pod fly at harvest, *i.e.* lowest pod and grain damage was recorded in module 1 with 2.62 and 4.2 per cent, respectively and was found significantly superior over rest of the treatments. The next better treatment found promising, was module 2 with 4.03 and 4.90 per cent pod and grain damage, respectively.

Effect of different insecticide modules on yield and incremental cost benefit ratio of pigeonpea (ICBR)

The pooled data revealed that the highest yield of pigeonpea was recorded in module 1 i.e. 18.22 Q per ha followed by module 2 with 17.89Q per ha and module 3 i.e. 16.83 Q per ha. Lowest yield recorded in untreated control i.e. 12.00. Patange and Chiranjeevi (2017) recorded highest grain yield with chlorantraniliprole which supports our findings.

Highest incremental cost benefit ratio was recorded in module 2 i.e. 3.92 and ranked first among all the modules. The next promising module was module 1 which recorded 3.72 incremental cost benefit ratio and ranked second among all the modules.

Conclusion

Module 1 (Thiodicarb 75WP *fb* chlorantriliniliprole 18.5 SC *fb* Lambda-cyhalothrin 5 EC) recorded lowest, larval population and per cent pod damage as well as grain damage due to pod borer complex. Higher yield was also recorded in module 1. However, the highest incremental cost benefit ratio was recorded in module 2 (Thiodicarb 75WP *fb* Flubendiamide 39.35 SC *fb* L-cyhalothrin 5 EC). Hence, module 2 and module 1 was proposed for the recommendation for the management of podborer complex of pigeonpea and also for obtaining higher yield.

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Soil physical and chemical properties as influenced by the application of fertilizers, FYM and lime in an acid soil

Ankita Mohapatra^{1, 3*}, Raj Paul Sharma¹, Narender Kumar Sankhyan¹ and Sandeep Manuja²

Department of Soil Science, College of Agriculture, CSKHPKV, Palampur, Himachal Pradesh, 176062, India

Department of Agronomy, College of Agriculture, CSKHPKV, Palampur, Himachal Pradesh, 176062, India

Introduction

Soil acidity is a major constraint in crop production that severely affects soil health and agricultural sustainability. It is accelerated by certain crop production practices, imbalanced use of fertilizers, heavy rainfall leading to leaching of bases or may be due to the influence of parent material, temperature and vegetation. The tolerance of maize crop to acidic soils is very low. Hence, monitoring soil pH is imperative for achieving optimum productivity and restoring soil health. By evaluating the effects of different soil management practices, including fertilizers, farmyard manure (FYM) and lime, on soil physical and chemical properties and maize yield, the study aims to provide insights into the most effective ways to manage acid soils under maize cultivation.

Methodology

The field experiment was conducted at Palampur, Himachal Pradesh, India, during *kharif* 2021 with eleven treatments comprising 100% NPK, 100% NPK with different combinations of FYM (5 and 10t ha⁻¹) and lime [100% and 1/10th Lime Requirement (LR)], Natural Farming and control, replicated three times in a randomized block design. After the harvest of maize, soil samples were collected and the data on grain and stover yield of maize was recorded. The bulk density (BD) of the soil was calculated by the core sampler method, and the water holding capacity (WHC) of the

soil was determined using Keen's moisture box. Soil pH was determined in the ratio of 1:2.5 (soil: water suspension). Soil organic carbon (SOC) was determined by the chromic acid wet oxidation method. The cation exchange capacity (CEC) of the soil was determined by the neutral normal ammonium acetate extraction method.

Results

The combined application of FYM and lime with 100% NPK resulted in significantly lower BD compared to the application of 100% NPK, Natural Farming and control. The highest WHC was recorded by the application of 100% NPK with 10t FYM ha⁻¹ and lime incorporation @ 100% LR. Treatments comprising lime with 100% NPK or lime with 100% NPK and FYM recorded higher pH than the rest of the treatments. Integrated application of FYM, lime and fertilizers significantly increased SOC and CEC in the soil. The lowest values of WHC, pH, SOC and CEC were recorded in control plots followed by 100% NPK and Natural Farming plots. The highest grain (59.4 q ha⁻¹) and stover (90.8 q ha⁻¹) yield of maize was recorded in the treatment comprising 100% NPK + 10 t FYM ha⁻¹ + lime incorporation @ 100% LR, which was at par with 100% NPK + 10 t FYM ha⁻¹ + lime incorporation @ 1/10th LR in furrow (54.2 and 85.3 q ha⁻¹, respectively).

Conclusions

The conjoint application of chemical fertilizers, manure and lime improved physical and chemical properties of soil as well as maize yield significantly. Moreover, the furrow application of lime at a reduced dose of 1/10th of LR produced yield at par with full dose of lime without sacrificing productivity. Achieving higher crop yield while maintaining soil health and sustainability requires a proper soil management approach including the judicious use of fertilizers, FYM and lime.

Keywords: Acid Soils, Fertilizers, FYM, Lime, Maize yield, Soil Properties

Compatibility of vermi wash as growth stimulant with insecticides in the management of pod borer, *h. Armigera* in pigeon pea

Karabhantanal, S. S.¹, Patil, S B.², Pattar, P. S.³ and Jolli, R.B.⁴

¹ AICRP on sorghum, ² AICRP on DLA, ³AICRP on Agro-meteorology, ⁴ Seed Science & Technology

Regional Agricultural Research Station, Vijayapura-586 101, University of Agricultural Sciences, Dharawad, Karnataka, India

Introduction

Pulses are known as the "poor man's meat" are excellent supplement of protein in the vegetarian diet of human being. All pulses in general and pigeon pea in particular are attacked arrays of insect pests. Among them pod borer, *Helicoverpa armigera* (Hub.) is major once. Management of pod borer complex through chemical approach is not acceptable worldwide due to increased concern for environmental awareness. It has evoked a interest in the use of pest control agents of biological origin. Earthworms assimilate nutrients and energy from a wide range of ingested materials with variable efficiency. Vermiwash, is a liquid fertilizer collected after the passage of water through a column of worm activation. It is a excretory products of earthworms along with major micronutrients and plant growth hormones that are useful for plants. Most of the pigeon pea growing integrated farmers invariably mix the vermiwash with insecticides during flowering stage of the crop to combat pod borer as well as to avoid the flower dropping. Keeping these points in view, little efforts was made to reduce the chemical usage on the pigeon pea crop with the following objectives.

Objectives

To study the compatibility of vermi wash with insecticides in the management of pod borer, *H. armigera* in pigeon pea

To study the effect of vermiwash on growth and yield parameters in pigeon pea.

Material and methods:

Design: RCBD (Randomized Complete Block Design)

Treatment details:

T₁-Chlorantraniliprole 18.50 SC @ 0.15 ml/l + Vermi wash 10%

T₂- Flubendiamide 39.35% M/M SC @ 0.07ml/lit + Vermi wash 10%

T₃- Chlorfenpyr 24%SC @ 1 ml/l + Vermi wash 10%

T₄- Emamectin benzoate 5SG @ 0.20g + Vermiwash 10%

T₅- NSKE 5% + Vermi wash 10%

T₆ - NSKE 5%

T₇- Vermi wash 10%

T₈- Emamectin benzoate 5SG @ 0.20g/lit

T₉-Flubendiamide 39.35% M/M SC @ 0.07ml/lit

T₁₀- Chlorfenpyr 24%SC @ 1 ml/l (Std check)

T₁₁- Chlorantraniliprole 18.50 SC @ 0.15 ml/l

T₁₂-UTC

First spray was given when insect crosses ETL (1.0 larvae/plant) and subsequent sprays were given at 15 days intervals. Vermiwash was extracted by following University package of practice (Anon, 2020). Observations on insect pest incidence, pod damage, crop growth and yield parameters were taken by following standard operating procedure recommended for pigeon pea.

Results

The two years investigations to validate the compatibility of vermiwash with new molecules in the management of pod borer, *H. armigera* in pigeon pea and their impact on growth and yield parameters revealed that significantly lowest larval incidence was recorded in vermiwash @ 10% combined with chlorantraniliprole 18.50 SC @ 0.15 ml/l (1.04, 0.36 & 0.07 larvae/pl) which was on par with vermiwash @ 10% + Flubendiamide 39.35% M/M SC @ 0.07ml/lit (1.12, 0.44 & 0.07 larvae/pl), Chlorfenpyr 24%SC @ 1.0 ml/l (1.08, 0.39 & 0.07 larvae/pl) and emamectin benzoate 5SG @ 0.20g/lit (0.53, 0.52 & 0.13 larvae/pl) after first, second and third sprays, respectively. These treatments were equally effective as that of without combination vermiwash treatments. (fig 1). Per cent pod damage caused by pod borer is a measure of actual effectiveness of the treatments. Significantly lowest pod damage and highest yield per ha was registered in combination of vermiwash @ 10% with chlorantraniliprole 18.50 SC @ 0.15 ml/l (8.42% & 1489kg/ha) which was on par with vermiwash @ 10% + Flubendiamide 39.35% M/M SC @ 0.07ml/lit (8.76% & 1449 kg/ha), Chlorfenpyr 24%SC @ 1.0 ml/l (8.20 % & 1476 kg/ha) and emamectin benzoate 5SG @ 0.20g/lit (9.96% & 1408 kg/ha) (fig 2). The growth parameters like plant height and number of branches per plant did not influence significantly by the combination of vermiwash with in any of the insecticide treatments. Stalk yield was significantly influenced by combination of vermiwash with insecticides. Wherein, vermiwash 10% with chlorantraniliprole 18.50 SC (4767kg/ha) flubendiamide 39.35% M/M SC (4670 kg/ha), and chlorfenpyr 24%SC (4733 kg/ha) and emamectin benzoate 5SG (4596 kg/ha) were equally effective and recorded highest stalk yield compared to without vermiwash combination treatments.

Conclusion

Vermiwash @ 10% combined with chlorantraniliprole 18.50 SC @ 0.15 ml/l, Flubendiamide 39.35% M/M SC @ 0.07ml/lit, Chlorfenpyr 24%SC @ 1.0 ml/l, and emamectin benzoate 5SG @

0.20g/lit were equally effective as that of without combination vermivash treatments. Hence . Vermivash @ 10% can be used as growth stimulants along with insecticides while managing the insect pests in pigeon pea eco system.

References

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Treatment details:	
T ₁ -Chlorantraniliprole 18.50 SC @ 0.15 ml/l + Vermivash 10%	T ₇ - Vermivash 10%
T ₂ - Flubendiamide 39.35% M/M SC @ 0.07ml/lit + Vermivash 10%	T ₈ - Emamectin benzoate 5SG @ 0.20g/lit
T ₃ - Chlorfenpyr 24%SC @ 1 ml/l + Vermivash 10%	T ₉ -Flubendiamide 39.35% M/M SC @ 0.07ml/lit
T ₄ - Emamectin benzoate 5SG @ 0.20g + Vermivash 10%	T ₁₀ - Chlorfenpyr 24%SC @ 1 ml/l (Std check)
T ₅ - NSKE 5% + Vermivash 10%	T ₁₁ - Chlorantraniliprole 18.50 SC @ 0.15 ml/l
T ₆ - NSKE 5%	T ₁₂ -UTC

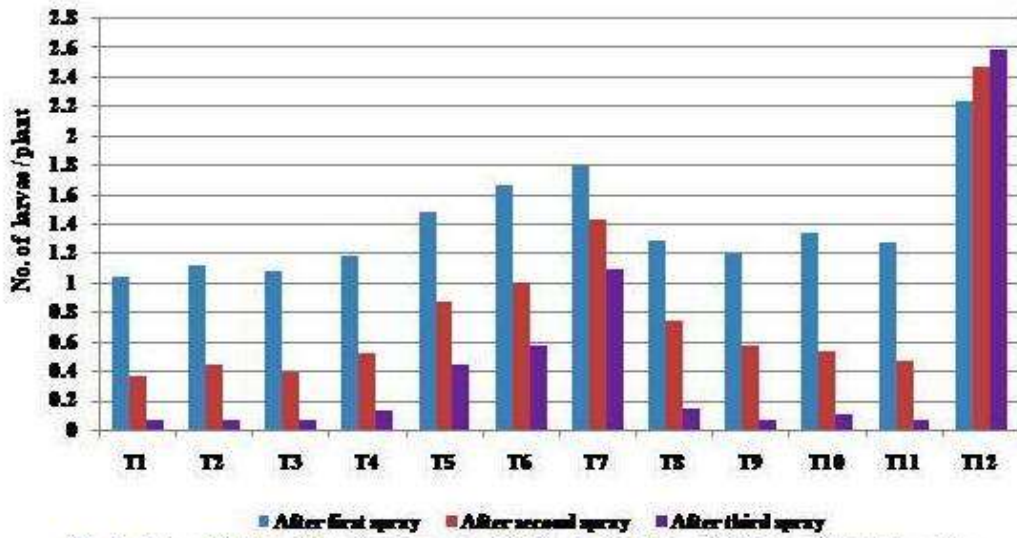


Fig 1 : Compatibility of vermicompost as growth stimulant with insecticides and their impact on larval incidence, pod damage and yield in pigeon pea and

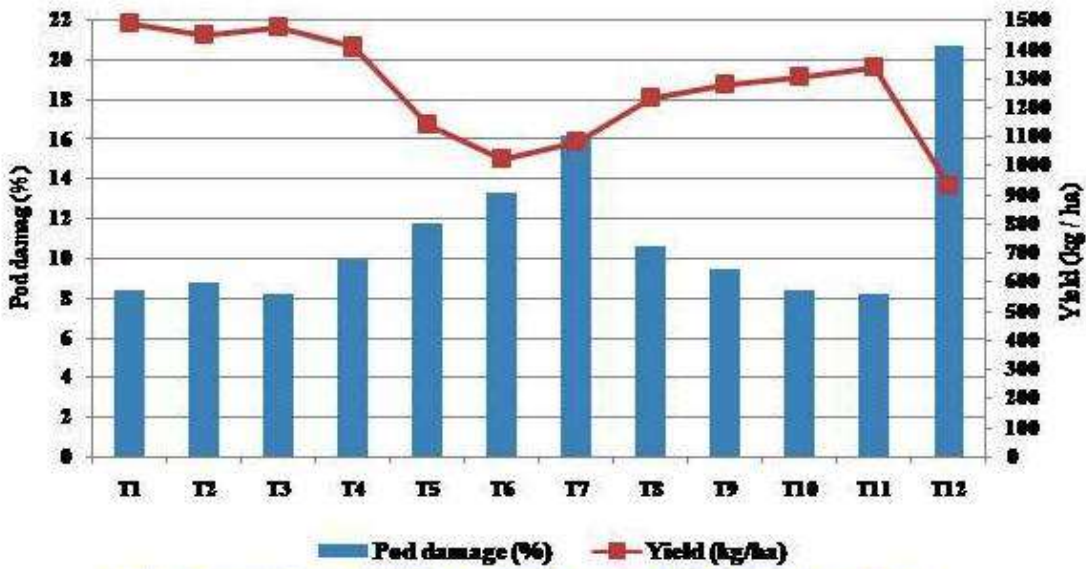


Fig 2 : Compatibility of vermicompost as growth stimulant with insecticides and their impact on pod damage and yield in pigeon pea and

Table 1 : Compatibility of vermi wash as growth stimulant cum bio-pesticides with insecticides in the management of pod borer, *H. armigera* in pigeon pea

Treatments	Number of <i>H. armigera</i> larvae / plant											
	Pre-treatment count			10 Days after first spray			10 Days after secondspray			10 Days after third spray		
	2020-21	2021-22	Pooled	2020-21	2021-22	Pooled	2020-21	2021-22	Pooled	2020-21	2021-22	Pooled
T ₁ -Chlorantraniliprole 18.50 SC @ 0.15 ml/l + Vermi wash 10%	2.27 (1.66)	2.00 (1.58)	2.17 (1.63)	1.00 (1.22)	1.07 (1.25)	1.04 (1.24)	0.33 (0.91)	0.33 (0.91)	0.36 (0.93)	0.07 (0.75)	0.07 (0.75)	0.07 (0.75)
T ₂ - Flubendiamide 39.35% M/M SC @ 0.07ml/lit + Vermi wash 10%	2.33 (1.68)	1.93 (1.56)	2.15 (1.63)	1.07 (1.25)	1.17 (1.29)	1.12 (1.27)	0.33 (0.91)	0.47 (0.98)	0.44 (0.97)	0.07 (0.75)	0.07 (0.75)	0.07 (0.75)
T ₃ - Chlorfenpyr 24%SC @ 1 ml/l + Vermi wash 10%	2.20 (1.64)	2.07 (1.60)	2.17 (1.63)	1.07 (1.25)	1.07 (1.25)	1.08 (1.26)	0.40 (0.95)	0.33 (0.91)	0.39 (0.94)	0.07 (0.75)	0.07 (0.75)	0.07 (0.75)
T ₄ - Emamectin benzoate 5SG @ 0.20g + Vermiwash 10%	2.40 (1.70)	2.00 (1.58)	2.21 (1.65)	1.13 (1.28)	1.20 (1.30)	1.18 (1.30)	0.53 (1.01)	0.51 (1.00)	0.52 (1.01)	0.13 (0.79)	0.13 (0.79)	0.13 (0.79)
T ₅ - NSKE 5% + Vermi wash 10%	2.33 (1.68)	2.07 (1.60)	2.22 (1.65)	1.53 (1.42)	1.43 (1.39)	1.48 (1.41)	0.80 (1.14)	0.93 (1.20)	0.87 (1.17)	0.27 (0.88)	0.60 (1.05)	0.44 (0.97)
T ₆ - NSKE 5%	2.40 (1.70)	1.93 (1.56)	2.17 (1.63)	1.67 (1.47)	1.60 (1.45)	1.66 (1.47)	1.00 (1.22)	1.00 (1.22)	1.00 (1.22)	0.40 (0.95)	0.73 (1.11)	0.57 (1.03)
T ₇ - Vermi wash 10%	2.43 (1.71)	1.83 (1.53)	2.13 (1.62)	1.87 (1.54)	1.67 (1.47)	1.79 (1.51)	1.33 (1.35)	1.53 (1.42)	1.43 (1.39)	0.80 (1.14)	1.40 (1.38)	1.10 (1.26)
T ₈ - Emamectin benzoate 5SG @ 0.20g/lit	2.40 (1.70)	2.13 (1.62)	2.27 (1.66)	1.27 (1.33)	1.33 (1.35)	1.29 (1.34)	0.80 (1.14)	0.67 (1.08)	0.74 (1.11)	0.13 (0.79)	0.17 (0.82)	0.15 (0.81)
T ₉ -Flubendiamide 39.35% M/M SC @ 0.07ml/lit	2.27 (1.66)	2.03 (1.59)	2.15 (1.63)	1.13 (1.28)	1.27 (1.33)	1.20 (1.30)	0.53 (1.01)	0.60 (1.05)	0.57 (1.03)	0.07 (0.75)	0.07 (0.75)	0.07 (0.75)
T ₁₀ - Chlorfenpyr 24%SC @ 1 ml/l (Std check)	2.37 (1.69)	1.97 (1.57)	2.17 (1.63)	1.47 (1.40)	1.20 (1.30)	1.34 (1.35)	0.53 (1.01)	0.53 (1.01)	0.53 (1.01)	0.07 (0.75)	0.13 (0.79)	0.11 (0.78)
T ₁₁ - Chlorantraniliprole 18.50 SC @ 0.15 ml/l	2.60 (1.76)	2.17 (1.63)	2.39 (1.70)	1.37 (1.37)	1.17 (1.29)	1.27 (1.33)	0.47 (0.98)	0.47 (0.98)	0.47 (0.98)	0.07 (0.75)	0.07 (0.75)	0.07 (0.75)
T ₁₂ . UTC	2.20 (1.64)	1.87 (1.54)	2.04 (1.59)	2.40 (1.70)	2.07 (1.60)	2.24 (1.65)	2.60 (1.76)	2.33 (1.68)	2.47 (1.72)	2.80 (1.82)	2.37 (1.69)	2.59 (1.76)
C.D. @ 5%	NS	NS	NS	0.18	0.14	0.15	0.09	0.15	0.12	0.07	0.10	0.09
S.Em.±	0.05	0.03	0.07	0.06	0.05	0.05	0.03	0.05	0.04	0.02	0.03	0.03
C.V. (5%)	12.35	14.23	16.33	13.55	12.19	16.02	11.33	13.44	14.33	12.68	14.56	15.02

Table 2 : Compatibility of vermi wash as growth stimulant cum bio-pesticides along with insecticides and their impact on yield and yield parameters in Pigeon pea

Treatments	Pod damage (%)			Grain yield (Kg/ha)		
	2020-21	2021-22	Pooled	2020-21	2021-22	Pooled
T1-Chlorantraniliprole18.50 SC @ 0.15 ml/l + Vermi wash 10%	7.81 (16.23)	8.95 (17.41)	8.42 (16.87)	1613	1364	1489
T2- Flubendiamide39.35% M/M SC @ 0.07ml/lit + Vermi wash 10%	8.45 (16.90)	9.01 (17.47)	8.76 (17.22)	1578	1319	1449
T3- Chlorfenpyr 24%SC @ 1 ml/l + Vermi wash 10%	7.65 (16.06)	8.63 (17.08)	8.20 (16.64)	1597	1355	1476
T4- Emamectin benzoate 5SG @ 0.20g + Vermiwash 10%	9.76 (18.20)	10.04 (18.47)	9.96 (18.40)	1527	1288	1408
T5- NSKE 5% + Vermi wash 10%	11.22 (19.57)	12.07 (20.33)	11.75 (20.05)	1264	1018	1141
T6 - NSKE 5%	12.87 (21.02)	13.56 (21.61)	13.27 (21.36)	1154	891	1022
T7- Vermi wash 10%	15.47 (23.16)	16.89 (24.27)	16.21 (23.74)	1205	960	1083
T8- Emamaectin benzoate 5SG @ 0.20g/lit	10.34 (18.76)	10.93 (19.31)	10.66 (19.06)	1373	1095	1234
T9-Flubendiamide 39.35% M/M SC @ 0.07ml/lit	9.05 (17.51)	9.79 (18.23)	9.48 (17.93)	1416	1138	1277
T10 - Chlorfenpyr 24%SC @ 1 ml/l (Std check)	7.81 (16.23)	8.95 (17.41)	8.40 (16.85)	1446	1168	1307
T11- Chlorantraniliprole 18.50 SC @ 0.15 ml/l	7.65 (16.06)	8.63 (17.08)	8.24 (16.68)	1478	1200	1339
T12- UTC	19.78 (26.41)	21.67 (27.74)	20.76 (27.11)	1074	785	930
C.D. @ 5%	0.97	1.16	1.36	139	145	151
S.Em.±	0.32	0.39	0.45	47	49	51

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C.V. (5%)	14.33	15.07	17.05	12	15	14
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Table 3 : Compatibility of vermi wash as growth stimulant cum bio-pesticides along with insecticides and their impact on plant growth parameters in Pigeon pea

Treatments	Plant height (cm)			No. of branches/plant			Stalk yield (kg/ha)		
	2020-21	2021-22	Pooled	2020-21	2021-22	Pooled	2020-21	2021-22	Pooled
T1-Chlorantraniliprole 18.50 SC @ 0.15 ml/l + Vermi wash 10%	174.0	160.0	167.0	12.77	11.5	12.2	5250	4284	4767
T2- Flubendiamide 39.35% M/M SC @ 0.07ml/lit + Vermi wash 10%	172.7	156.0	164.3	12.63	11.3	12.0	5164	4176	4670
T3- Chlorfenpyr 24%SC @ 1 ml/l + Vermi wash 10%	173.7	158.3	166.0	12.47	11.4	11.9	5210	4256	4733
T4- Emamectin benzoate 5SG @ 0.20g + Vermiwash 10%	170.7	157.3	164.0	12.50	11.2	11.8	5097	4095	4596
T5- NSKE 5% + Vermi wash 10%	164.3	150.7	157.5	11.27	10.1	10.7	4298	3329	3813
T6 - NSKE 5%	160.3	148.7	154.5	10.97	9.6	10.3	3951	3031	3491
T7- Vermi wash 10%	163.3	149.7	156.5	11.20	9.8	10.5	4048	3215	3632
T8- Emamectin benzoate 5SG @ 0.20g/lit	163.7	151.7	157.7	11.57	10.2	10.9	4586	3558	4072
T9-Flubendiamide 39.35% M/M SC @ 0.07ml/lit	164.7	152.0	158.3	11.63	10.1	10.9	4681	3630	4156
T10 - Chlorfenpyr 24%SC @ 1 ml/l (Std check)	166.0	152.3	159.2	12.03	10.6	11.3	4775	3756	4266
T11- Chlorantraniliprole 18.50 SC@0.15 ml/l	165.3	152.7	159.0	12.00	10.6	11.3	4837	3853	4345
T12- UTC	157.0	144.7	150.8	10.47	9.1	9.8	3642	2636	3139
C.D. @ 5%	5.90	6.40	4.30	0.50	0.50	0.50	163	146	147
S.Em.±	NS	NS	NS	NS	NS	1.40	478	429	430
C.V. (5%)	12.30	14.60	9.40	7.80	9.00	8.90	12	14	12

Response of *Bt* cotton to different spacing and sowing dates under rainfed condition

A. D. Pandagale, K. S. Baig and Bhede B. V.

Cotton Research Station, Nanded (VNMKV, Parbhani)

Introduction

The most crucial factors affecting the cotton crop yield are the planting time and plant population. The cotton plant has indeterminate growth habit which allows it to adjust its fruiting patterns in response to plant populations. Thus, enabling it to be cultivated at a wide range of plant populations. The crop sowing is dependent on onset of monsoon under rainfed situation and hence many times delayed to want of sufficient rainfall. Plant population can be adjusted to minimize yield losses. Hence, present studies were conducted to determine the effect of sowing dates with different plant spacing (population) under rainfed condition in Central Maharashtra Plateau Zone.

Materials and methods

The study was conducted at Cotton Research Station, Nanded, Maharashtra (lies in between 19.1383° N latitude and 77.3210° E longitude.) during 2020-21 season. The field trial conducted with four spacing and four sowing dates, laid out in split plot design replicated three times. The *Bt* cotton (*Gossypium hirsutum* L.) hybrid NHH 44 (BG II) was dibbled on various plant spacing 120 x 45 cm (18,518 plants / ha), 120 x 30 cm (27,777 plants/ha) 90 x 60 cm (18,518 plants/ha) and 90 x 45 cm (24,691 plants/ha) which were kept as main plots whereas sowing dates (16th June, 2nd July, 19th July and 2nd August) were maintained as sub plots.

Results and discussion

Significantly highest number of bolls m⁻² was observed in 120 x 30 cm (72.00), highest yield plant⁻¹ was in 120 x 45 cm (87.72 g). The seed cotton yield ha⁻¹, GMR and NMR remained unaltered due to different spacing. The spacing 120 x 30 cm (27,777 plants ha⁻¹) recorded highest seed cotton yield (1616 kg ha⁻¹) and GMR (Rs. 88692 ha⁻¹). It was at par with all other spacing of *Bt* cotton. The sowing of cotton at onset of monsoon recorded significantly higher bolls m⁻² (92.08) and yield plant⁻¹ (106.25 g) over delayed sowing. Sowing at onset of monsoon (16th June, 2020) recorded significantly highest seed cotton yield (2252 kg ha⁻¹), GMR (Rs. 123628 ha⁻¹), NMR (Rs. 53178 ha⁻¹) and BCR. Seed cotton yield ha⁻¹ was found to be reduced significantly by every delayed sowing date treatment. Plant spacing had significant impact in last date of sowing. However, during first three dates of sowing (D₁ and D₂) the effect of various spacing was statistically similar. During 4 weeks after onset of monsoon, spacing 90 x 60 cm was remunerative whereas at 6 weeks after sowing, sowing at 120 x 30 cm was significant for seed cotton yield over 120 x 45 cm and 90 x 60 cm.

Conclusion : Delay in sowing of *Bt* cotton by two weeks reduced seed cotton yield significantly over previous sowing. Hence sowing at onset is profitable. Spacing of 120 x 45 cm is remunerative at onset of monsoon and 2 weeks delay whereas, If sowing is delayed by four weeks, should be done at 90 x 60 cm.

Table 1. Seed cotton yield, yield contributing and plant growth characters and economics as affected due to spacing and sowing date

Treatment	Seed cotton yield (kg ha ⁻¹)	Yield plant ⁻¹ (g)	No. of Bolls m ⁻²	Boll weight (g)	GMR (₹ ha ⁻¹)	NMR (₹ ha ⁻¹)	BCR

Main plot : Spacing							
S ₁ : 120 x 45 cm	1578	87.72	63.42	2.65	86640	22973	1.34
S ₂ : 120 x 30 cm	1616	58.82	72.00	2.40	88692	22560	1.33
S ₃ : 90 x 60 cm	1562	86.33	64.83	2.55	85729	22195	1.33
S ₄ : 90 x 45 cm	1612	66.20	67.17	2.49	88499	21154	1.30
SE _±	35.03	2.21	1.69	0.64	1925	1644	0.02
CD at 5%	N.S.	6.45	4.95	N.S.	N.S.	N.S.	N.S.
II) Sub plot : Sowing dates							
D ₁ : Onset of monsoon	2252	106.25	92.08	2.61	123628	53178	1.75
D ₂ : 2 WAOM	1637	75.80	68.67	2.51	89859	24329	1.37
D ₃ : 4 WAOM	1358	64.37	58.42	2.48	74530	11235	1.18
D ₄ : 6 WAOM	1121	52.65	48.25	2.47	61543	140	1.00
SE _±	31.09	1.68	1.76	0.57	1706	1457	0.02
CD at 5%	90.61	4.90	5.14	N.S.	4972	4247	0.06
Interaction S x D							
SE _±	62.17	3.36	3.52	0.12	3412	2914	0.04
CD at 5%	181.21	9.81	N.S.	N.S.	9944	8495	0.12
CV (%)	6.76	7.80	9.14	7.93	6.76	22.72	5.44
GM	1222	74.76	66.85	2.52	87390	22221	1.32

Table 2. Interaction effect of Spacing x Genotype (S x D)

Spacing	Date of sowing							
	Seed cotton yield (kg ha ⁻¹)				NMR (C ha ⁻¹)			
	D ₁ : Onset of monsoon	D ₂ : 2 WAOM	D ₃ : 4 WAOM	D ₄ : 6 WAOM	D ₁ : Onset of monsoon	D ₂ : 2 WAOM	D ₃ : 4 WAOM	D ₄ : 6 WAOM
S ₁ : 120 x 45 cm	2344	1618	1380	969	58907	24853	13703	-5571
S ₂ : 120 x 30 cm	2216	1659	1338	1247	50755	24631	9547	5309
S ₃ : 90 x 60 cm	2169	1613	1433	1030	50692	24608	16196	-2717
S ₄ : 90 x 45 cm	2277	1656	1278	1236	52358	23226	5493	3540
SE _±	62.18				2914			
CD at 5%	181.21				8495			

(WAOM - weeks after onset of monsoon)

Effect of edible coatings supplemented with essential oils on the shelf life of guava**¹Jyoti Bharti Sharma*, ¹Manish Bakshi, ¹Ab Waheed Wani, ¹Nidhi Chauhan, ¹Madhurima Chaudhuri***¹Department of Horticulture, School of Agriculture Lovely Professional University, Punjab-144411***Abstract**

Purpose: In guava, maintenance of post-harvest quality is a biggest challenge. The present study was carried out at Horticulture laboratory of Lovely Professional University, Phagwara (Punjab) on guava cv. Allahabad Safeda with the objective of enhancement of shelf life along with quality using different concentrations of essential oils.

Method

The experiment was laid in Completely Randomized Block Design (CRBD) with eleven treatments using different formulations of essential oils viz. lemongrass oil, tea tree oil, rosewood oil and their blends as coating material along with Aloe Vera gel. Treatment combinations for this experimental study included Aloe vera gel, Aloe vera + Lemongrass oil (2ml), Aloe vera + Lemongrass oil (4ml), Aloe vera + Tea tree oil (2ml), Aloe vera + Tea tree oil (4ml), Aloe vera + Rosewood oil (2ml), Aloe vera + Rosewood oil (4ml), Aloe vera + Lemongrass (2ml) + Tea tree oil (2ml), Aloe + Lemongrass oil (2ml) + Rosewood oil (2ml), Aloe vera + Tea tree oil (2ml) + Rosewood oil (2ml) and untreated control.

Results and discussion

Results indicated that, guava fruits coated with Aloe Vera + Tea tree oil (2ml) thrived for 12 days under ambient storage conditions with least losses in quality as compared to control. Application of tea tree oil (2ml) and aloe vera + tea tree oil (2ml) resulted in retention of maximum fruit weight (177.3 g), reduced physiological loss in weight (7.86%), maintained firmness (1.16) and decreased spoilage (11.07%). Similarly, all the biochemical parameters viz. minimum TSS (10.6 brix), maximum acidity (0.33%) minimum TSS/Acid ratio (37.29), decreased total sugar (7.70%), reducing sugars (6.12%), non-reducing sugar (1.85%) and maximum Vitamin C content (101.00 mg per 100 ml) was found with Aloe vera gel + Tea tree oil (2ml) on 12th day. Apart from it, all the sensory parameters viz. color, taste and overall acceptability were also enhanced by the same treatment (Aloe vera gel + Tea tree oil (2ml)).

Conclusion: It is concluded from the current study that application of edible coatings incorporated with tea tree oil was very helpful to decrease respiration rate and transpiration rate related losses in fruits by acting as strong barrier between inner as well as outer environment of fruits and maintained fruit quality throughout the storage period.

Keywords: Shelf life, essential oils, biochemical parameters, sensory parameters

Study On Dairy Cow Body Condition Score In Kallakurichi District Of Tamilnadu, India**Rajadurai *, S. Alimudeen, D. Anandha Prakash Singh and P.N. Richard Jagatheesan***Department of Livestock Production Management, VCRI, Theni, TANUVAS***Purpose**

Body scoring is much important parameter in assessing the health status of the animal indirectly. Low and high score may indicate disease/ improper feeding and high probability of breeding/ metabolic problems respectively.

Methods

A study was conducted to identify the body condition score in Kallakurichi district of Tamilnadu, India. Total of 90 framers having minimum of three dairy cattle were selected by stratified random sampling method ensuring the samples were distributed normally. Body Condition Score of every cow was assessed by the researcher by personal observation. The five point scoring method developed by NDRI was adopted for this purpose.

Results

Out of 328 dairy cows, a large majority (80.79 %) of the dairy cows had a body condition score of 3 followed by 2 (10.06%) and 4 (9.15%).

Conclusion

This indicated that most of the cows in Kallakurichi were having frame and covering well, high producing, but body fat may not be enough for peak production.

Keywords: Body Condition Score, Kallakurichi, Milch Cow

Impact of climatic factors on silkworm cocoon production and productivity in different agro climatic zones of Karnataka

B.S. Ramesha*, N. B. Jyothi, V.G. Maribashetty, Rajendra Mundkur, N. Siddalingaswamy, R. Ravikumar and Ahalya, B.N.

Karnataka State Sericulture Research and Development Institute (KSSRDI), Thalaghattapura, Bangalore – 560109, Karnataka, India.

Introduction: Climate is the most influential factor guiding and moderating the life functions of all organisms. Sericulture involved in growing mulberry plants and rearing the silkworm, is also influenced by climatic conditions. Mulberry cultivation is an outdoor activity, directly exposed to climatic parameters and silkworm rearing is an indoor activity, controlled or moderated by external process of climatic regulation. In Karnataka with diverse eco-climatic areas, varying weather characters and varied financial status. Hence, it is imperative that climatic changes do impact the sericulture industry. However, in reality the impacts are mostly negotiated through various adaptation or mitigation measures taken up by both governmental agencies and farmers level efforts. The current study was to see whether the climate change has any impact on sericulture industry on a temporal scale (long term change in 30 years).

Methods: The experiment was conducted during the year 2021-22, the impact of climate change on the sericulture attributes of historic data on productivity and climatic parameters was collected from all 30 districts and pooled as per the agro-climatic zones of Karnataka. District-wise data was collected, and year-wise analysis was done for thirty years from 1990-91 till 2019-20 on the following parameters.

a) Climatic Factors.

(i) Minimum Temperature, (ii) Maximum Temperature, (iii) Annual Rainfall and Relative Humidity

b) Parameters of sericulture

(i) Mulberry Area in hectares, (ii) Disease Free Layings (Dfls) brushed in lakhs, (iii) Cocoon harvested in Metric Tons

Results: About 95.2% silk cocoon production is obtained in three zones namely, Eastern dry zone (61.84%), Southern dry zone (25.68%) and Central dry zone (7.88%). All the other 7 zones contribute 4.8% of the total cocoon production of Karnataka State. Regression R^2 values indicate that the zones with maximum productivity have least variance and the R^2 value is very less and insignificant. Eastern dry zone with maximum production has R^2 value of 0.157, the second largest

producer, Southern dry zone has R^2 value of 0.028, and the third largest producer zone has R^2 value of 0.383. This indicates that the cocoon production is influenced by the specific zone and its set of innate characteristics and that the changes in climatic parameters do not have significant influence on cocoon production. The R^2 value was >0.5 indicates that the production is influenced by other factors; mainly the environmental parameters. All the other 7 zones which contribute 4.8% of the total cocoon production, have R^2 value of >0.5 indicating that, these zones are very much affected by environmental conditions.

As inferred by the data analysis, when the environmental parameters are compared with cocoon production (actual production) or cocoon productivity (cocoon production per unit hectare of mulberry garden) there is no strong correlation. But logically, the environmental parameters are related to cocoon productivity. Therefore, second set of data analysis was performed, wherein, the difference in different parameters and difference in cocoon productivity was analyzed using Spearman's Correlation analysis.

In this analysis it was inferred that, the rainfall and temperature are significantly correlated with cocoon productivity. The rainfall in 1991 in different districts is considered as initial rainfall data and the rainfall in different districts in 2020 is considered as final rainfall data. In the same way, initial cocoon productivity data (1991) and final cocoon productivity data (2020) are calculated. The difference between the final and initial data is compared using Spearman correlation analysis. The analysis shows that the rainfall in different districts is significantly negatively correlated ($P < 0.0098$). Likewise, the temperature recorded at 5.30 pm in different districts (High Temperature) (difference between initial high temperature during 2002 and final high temperature during 2020) is positively correlated with cocoon productivity ($P < 0.04318$).

Conclusion:

It is obvious that no strong correlation of climatic parameters and productivity in established tracts of sericulture on a year to year basis, because of the fact that, not only the environment changes, but the breeds and technology have changed over a period of time. However, overall analysis on a long term scale shows that there is significant relation between rainfall/temperature and cocoon productivity. This study based on secondary data could show validation of the impact of long term climate change on sericulture. As it is a human oriented biological activity, there are many interventions and delineating the true impact of climate change is mostly difficult. The zonal variations on productivity itself indicate the role of eco-climatic conditions. More critical analysis is warranted to arrive at concrete conclusions.

Keywords; Cocoon productivity, Temperature, Rainfall, Climate, Silkworm, Agro-climatic zones

Seasonal incidence of major insect pests of cabbage

Vadluri pallavi, ss dhurgude*, dd patait and pr zanwar

Department of agricultural entomology, Vasantrya naik marathwada krishi vidyapeeth, parbhani

Purpose

The present investigations were carried out to study seasonal incidence of major insect pests of cabbage during winter 2021 at Department of Agricultural Entomology, Vasantrya Naik Marathwada Krishi Vidyapeeth, Parbhani.

Methods

To study seasonal incidence, the seedlings of cabbage were transplanted at the spacing of 60 x 60 cm in 2.15 x 2.15 m² area of 60 quadrates each and weekly observations were conducted.

Results

The larva of leaf webber *C. binotalis* was first spotted during 51st SMW and attained peak during 2nd SMW in 2021. The incidence of Head borer *H. Undalis* was observed during 51st SMW and its peak activity was observed during week 3rd SMW. The incidence of diamond backmoth *P. xylostella* was started in 51st week to 6th SMW. The peak activity was noticed during 4th SMW during winter 2021. The initiation and peak activity of tobacco leaf eating caterpillar *Spodoptera litura* was observed during 52nd SMW and its peak activity observed in 2nd SMW in 2021. The larva of *Condica illecta* was first observed during 1st SMW in winter during 2021. The peak was attained in 2nd SMW. The activity of *S. obliqua* was initiated during 51st SMW. The peak activity was noticed in 2nd SMW. Aphid *Brevycoryne brassicae* initiated during 51st SMW to 6th SMW and reached its peak activity during 2nd SMW with 112.2 aphids per quadrant, in 2021, respectively.

Conclusion:

The population of *C. binotalis*, *H. undalis* and *P. xylostella*, on cabbage varied from 1.2 to 23.4, 0.6 to 12.6, 0 to 0.8 larvae per five quadrats, respectively during winter season 2021-22. While the population of *S. litura*, *C. illecta* and *S. obliqua* ranged from 0.2 to 1.4, 0.2 to 0.2 and 0.2 larvae per five quadrats during winter season 2021, respectively.

Keywords: Pests of Cabbage, Leaf webber, Head borer, Diamondback moth, Tobacco leaf eating caterpillar, *Condica illecta*, Seasonal incidence.

Evaluation Of Macro And Micronutrients In Agroforestry Soils In Peri-Urban Areas Of Bengaluru, Karnataka, India

Rashmi. M, Nandini. N and Vishnu H V

Department of Environmental Science Bangalore University, Bangalore-560056

Purpose

Soils is an important Earth's system component and support food production and livestock. The yield of crops depends upon soil quality and the climatic conditions of the region. It helps to maintain soil quality at local, regional and global levels. The soil has an impact on human health in different ways and vice versa. It enhances human health through food production and nutrient supply. Physical and chemical parameters are used to assess the quality of the soil.

Methods

The present study evaluates the macro and micronutrients in agroforestry soils. The stratified random sampling technique was adopted to collect soil samples from agroforestry patches of peri-urban areas in Bengaluru.

Results

The results revealed that the macronutrients, such as available Nitrogen, available Phosphorus, available Potassium and Organic Carbon, ranged from low, medium and high concentrations. The micronutrients such as Zinc, Copper, Iron, Manganese and Boron ranged from deficient to sufficient as per the ranges prescribed by F.A.O. and Methods Manual – Soil Testing in India (Ministry of Agriculture, Government of India). The low soil nutrient concentration may be due to soil pollution caused by pesticide usage. The high soil nutrient concentration might be because of the usage of organic manure and biopesticides.

Conclusions

To overcome the adverse effect, the use of organic manure, biofertilizers, and organic farming is suggested.

Keywords – Agroforestry, contaminants, macronutrients, micronutrients, soils.

Major stressors associated with farming and family among farm women**Diksha Rani^{*}, Vandana Verma, Ella Rani and Shikha Bhukal***Department of EECM, CCSHAU, Hisar***Purpose**

Women's work is both wide-ranging and multifaceted throughout the year. They have to perform multiple tasks in the sphere of agriculture. Balancing work and family roles have become a key personal and family issue for women. Stressors referred as main cause of tension and discomfort in individual's life. There are many stressors which are financial problems, relationship issues and home responsibilities in every individual's life but some stressors like gender roles and responsibilities affect women's life badly. The complex challenge for health professionals in caring for women with mental disorders and physical discomforts related to their farm work, in the context of both the farm and domestic work. Therefore, present study has been planned to analyze stressors of farm women's life.

Methods

The study was carried out in two agro climatic zone of Haryana state. The objective of this study was to major stressors associated with farming and family among farm women. Data were collected with the help of pre- structured interview schedule by the investigator from selected 200 unpaid farm women.

Results

The results indicates as in farming stressors majority of the respondents have stress of financial risk, low level of demand, fluctuation in market price risk and insufficient regular cash flow to meet for daily necessities. More than half of the respondents felt major stressors as crop diseases, equipment problem. In family stressors major stressor was balancing work and family, no cooperation with family members and not involvement in decision making.

Conclusions:

The various stressors like financial issues, uncontrollable natural forces, family problem and dual role conflicts with respect to family and farm identified in the cited literature. This risk posed by additional stressors, such as those that are political, social, and ecological, such as soil toxicity and frequently increases agricultural costs, increasing climate uncertainty acting as the primary stressor. (Singh, R. K. *et al.*2020). For farm women there was many difficulties and for farm work they were not being paid so they have no satisfaction of their present status in their families.

Keywords:Stressors, Farm women, agriculture, household

Influence of elevated CO₂ and temperature on plant chemistry and performance of *Pectinophora gossypiella* (Saunders) in Bt cotton**Honnayya, Sreenivas, A. G., Kisan, B., Harischandra naik, Saroja N. Rao, Chinnababu V. Naik and Bheemanna, M.****Purpose**

Most of the studies on the effects of elevated CO₂ focused on plants' biochemical composition, and very few studies were carried out on the effects of elevated CO₂ on insect host plant interactions. So these interactions found to be more important in predicting the impact of climate change on the expression and stability of host plant resistance to insect pests.

Methods

This experiment was conducted under open top chambers at Centre for Agro-climate Studies, MARS, UAS, Raichur during 2020-21. The temperature was maintained using infrared heaters mounted two meters above canopy. The computer with uninterrupted power service was established for constant and continuous data recording and storing. Each chamber was fitted with sensors to measure temperature and relative humidity, this facilitated the continuous monitoring of temperature, CO₂, and relative humidity. The data was continuously recorded for the temperature, relative humidity and actual CO₂ concentration in ppm and displayed on the monitor continuously. The *Bt* cotton hybrid was raised individually in each OTC's (Open Top Chambers) treatments. Influence of different climate change variants on phytochemistry of *Bt* cotton and its effect on metabolism of *Pectinophora gossypiella* (Saunders). Each OTC was considered as a treatment for this study.

Results

Influence of different climate change variants on phytochemistry of *Bt* cotton and metabolism of *Pectinophora gossypiella* (Saunders) showed lot of variations in *Bt* cotton hybrid (Bindaas-7213) had higher carbon based compounds (leaf-chlorophyll, carbon, C:N ratio, and tannins, phenols, sugars and starch) and lower N-based compounds (flavonoids, nitrogen, soluble proteins and Cry proteins). The change in chemical components of host plants due to increased *e*CO₂ and temperature significantly affected the growth parameters of *P. gossypiella*, viz., reduced oviposition period, lower fecundity, decreased pupal weight and pupal period. However, the larval weight, larval period and total life-span was significantly longer for *P. gossypiella* fed elevated CO₂ grown transgenic *Bt* cotton hybrid compared with those of *P. gossypiella* grown in ambient CO₂ condition and reference plot. The activity of midgut proteases (Trypsin and chymotrypsin) and carbohydrates (α - amylase and cellulose) of *P. gossypiella* from the gut extract was found to be maximum in elevated CO₂ conditions as compared to the ambient CO₂ and reference plot conditions. The highest total protease activity was observed in elevated CO₂ conditions as compared to that of ambient CO₂ and reference plot conditions. Due to the increased digestive efficiency and metabolism of *P. gossypiella* larvae, but enhancing the activities of midgut proteases, carbohydrates and total proteases were negatively correlated with weight gain by the larvae and pupae which indicate decreased efficiency of conversion of digested food into body matter

Conclusions

Effect of different climate change variables on phytochemistry of *Bt* cotton and metabolism of *P. gossypiella*. Approximate digestibility of larvae reared on transgenic *Bt* cotton grown in elevated CO₂ and temperature was higher compared to that of larvae fed transgenic *Bt* cotton grown at ambient CO₂ and reference plot conditions. Because the efficacy of conversion of ingested food and digested food of the *P. gossypiella* was significantly reduced when fed transgenic *Bt* cotton grown in *e*CO₂ and temperature conditions. The *P. gossypiella* obtain their nutritional requirement by utilizing food from the different climatic regime and proper digestion of ingested food as the midgut is involved in the digestion of ingested food, the activity of digestive enzymes in the midgut are influenced by change in *e*CO₂ and temperature which in term effect on survival and development of *P. gossypiella*.

Keywords: Ambient CO₂, elevated CO₂, midgut proteases, and transgenic *Bt* cotton

Natural/ Organic Farming In Haryana: An Approach Towards Sustainability**Singh Kiran, Suman and Kohli Neelesh***Department of Family Resource Management, Chaudhary Charan Singh Haryana Agriculture University, Hisar, India, 125004.***Purpose**

Organic/ natural farming is a sustainable way of agriculture which provides fresh natural farm products. Organic/ natural farming works with nature in synchronization rather than against it. This is achieved by using various techniques to improve crop yields in a sustainable way, without harming the natural environment as well as the people who live and work in it. Working with organic/ natural agricultural practices offers an exclusive amalgamation of environment-friendly practices that require low external inputs, thereby contributing to increased food availability.

Methods

This study analyzes cost benefit ratio of organic and low-cost natural farming and also assess resource utilization and family quality index of the conventional, organic and low-cost natural farm families. The data were collected personally through Snowball technique from 150 respondents through a well-structured interview schedule.

Results

Findings of study revealed that benefit cost ratio of conventional, organic and natural farming were found to be 0.5, 0.42 and 0.17 respectively. Results depicted that farmer had medium level of knowledge regarding organic/ natural farming. Further, analysis of the association between knowledge & profile of farmers revealed that, age, education, class, family type, landholding, occupation, socio- economic status were positively correlated with knowledge regarding organic farming.

Conclusions

Organic farming is an efficient agricultural approach for environmental sustainability as it provides organic food, reduces the use of synthesized fertilizers, improves soil health and yield stability with no environmental concerns. The study recommends building of proper channels of communication for the farmers regarding information about organic farming and related governmental schemes/ programmes.

Keywords: Organic farming, Natural farming, Climate change, Sustainable agriculture.

Effect of automated variable single point trailer hitch system for 2WD tractors**Tage Tapang, Surya Chhetry, P. K. Pranav, M. U. Singh***North Eastern Regional Institute of Science and Technology, Arunachal Pradesh - 791109***Purpose**

There are large number of fatal accidents associated with 2WD tractors due to rollovers during haulage. The rollover may be longitudinal or lateral, the former being more prominent. Trailer hitch height plays an important role in the stable operation of tractor-trailer combination. The existing trailer hitch system, which is manually adjusted can be automated to minimise the manual intervention in varying the hitch height, and rollovers in dynamic condition.

Methods

The front axle dynamic load is an important parameter in determining the longitudinal stability of 2WD tractors. In this research, a load cell was used to measure the dynamic load on the front axle. The output from the load cell was used to determine the required position of the trailer hitch height. The existing single point hitch mechanism of the test tractor was replaced by a hydraulically

operated variable hitch system. The signals from the front axle load cell were fed to a microcontroller which processes these signals and actuates the hydraulic system to vary the hitch height as per the front axle load. Haulage tests were carried out to find the effect of the developed automation system on payload and slope traversing capacities.

Results

The test was conducted with 2000, 2500 and 3000 kg payloads on a 9.8% unpaved road slope. The recommended minimum safe front axle load under dynamic condition is at least 20% of the total static weight of the tractor. Also, excess load on the front axle leads to reduction in tractive efficiency as well as increase in rolling resistance and fuel consumption. The test revealed that the automation system was able to maintain the front axle load between 23.84 to 24.51% (above the minimum recommended safe limit) by varying the hitch height between 26 to 41 cm above the ground. Additionally, while operating with 3000 kg payload on 0.0, 5.0 and 9.8% road slopes, the front axle load was maintained between 24.34 to 24.51% by auto adjusting the hitch height within the designed limit.

Conclusions

The automation system can monitor and maintain the dynamic front axle load within the range of its recommended values and helps in improving tractor-trailer operational safety and reduce longitudinal rollover accidents.

Keywords: front axle load, rollover, hitch height, automation, payload.

Genetic study of F₂ and Identified Transgressive Segregants for Yield and Its related attributes in Bread Wheat (*Triticum aestivum* L.)

Parul Gupta^{1*}, Ravindra Prasad¹ and Mohit Sharma²

^{1*}Dept. of Genetics and Plant Breeding, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi-221 005 (India).

²Division of Genetics, ICAR- Indian Agricultural Research Institute, New Delhi-110012 (India).

Purpose

Wheat (*Triticum spp.*) is recognized as a key staple food crop, in many regions of the world, both in terms of the area under cultivation and as a reliable supply of food. In plant breeding programme, improvement in a crop usually involves exploitation of genetic variability for productive *per se* traits. Crop improvement for grain yield can be attained through identification of transgressive segregants based on parent and progeny performance in F₂ and F₃ segregating population and fixing desirable character combination. Keeping above scenario in mind, present investigation has been made to study the genetic architecture of F₂ generation and identified transgressive segregants for productivity *per se* traits in order to select outstanding genotypes from existing population.

Methods

The experimental material consisted of F₂ population of two wheat crosses viz., K 1006 x LOK 1 and PBW 343 x HUW 234. F₂ population of both crosses along with parents was sown in unreplicated plots. Data were collected on 100 randomly selected individual plants in cross K 1006x LOK 1 and 105 plants in PBW 343 x HUW 234 cross and 10 plants in each parent for 13 quantitative traits. In next season, identified transgressive segregants along with parents were grown in RCBD (Randomized complete block design) with three replications. Descriptive statistical data viz., mean, range and genetic parameters PCV, GCV, heritability and genetic advance were recorded on various yield contributing characters to study the genetic architecture of both populations.

Results

Narrow difference between PCV and GCV showed less influence of environment on expression of traits under investigation. High heritability coupled with high GAM was registered in F₂ segregants of both crosses for majority of the characters. Among identified transgressive segregants it was higher for most of the traits like GFD, SPL, AL, PL, SLPS, PLH, NET and AUSDC in F₃ generation depicting the predominance of additive gene action.

Conclusion

The present study confirms the usefulness of genetic variability in a population which serves as a basis for selecting outstanding genotypes from existing population. Importance of early generation selection *i.e.*, identification and study of transgressive segregants may have a greater influence on the breeding programme of wheat with respect to yield and its component characters.

Keywords: Transgressive segregants, Plant breeding, Genetic architecture, Genetic variability

Progression of bakanae disease of aromatic rice in relation to weather variables

Vikram Singh* and Ashwani Kumar

Department of Plant Pathology, Chaudhary Charan Singh Haryana Agricultural University, Hisar- 125004, India

Purpose

The bakanae disease is an emerging problem for the aromatic rice cultivation in India especially in North-west plain zone. Weather has an impact on all stages of the host and the pathogen life cycle, as well as disease progression. In order to manage and forecast bakanae disease it is important to understand the interaction between the host, pathogen and the environment.

Methods

So keeping this in view, an investigation was carried out at Rice research station Kaul, CCS HAU, Hisar during *khari* 2022, under natural condition on study of various effect of weather (maximum temperature, minimum temperature, rainfall, maximum relative humidity, minimum relative humidity, wind velocity and bright sunshine hours) on infestation of *Fusarium moniliforme* in basmati rice varieties, PB 1121 and CSR 30. Experiment was conducted in Randomized block design with five replications of each variety, spacing 20 X 15 cm². Disease progression was measured on varieties at weekly interval. Bakanae disease incidence was recorded visually as the percentage of area infected according to scale given by Fiyaz *et al.* (2014).

Results

In *khari* season among two varieties, PB 1121 variety showed the higher incidence (34.60%) whereas CSR 30 variety showed lower incidence (28.80%). The incidence of bakane disease in both varieties was significant and positively correlated with relative humidity morning (RHM) and was significant and negatively correlated with minimum temperature and wind velocity. Maximum temperature, rainfall and relative humidity evening (RHE) showed no impact on disease incidence. Coefficient of determination (R²) values was observed 0.94 and 0.93 in case of PB 1121 and CSR 30 varieties, respectively.

Conclusions

Weather variables played a major role in disease incidence in *khari* season in this location, among the two different varieties PB 1121 variety is susceptible to bakanae disease than CSR 30.

Keywords: Aromatic rice, *Fusarium moniliforme*, Bakanae, Weather variables

Constraints and strategies for sustainability of rice wheat cropping system in Indo-gangetic plains**Anil Kumar Saroha* and Sandeep Kumar Antil***CCS Haryana Agricultural University, Hisar-125004, Haryana, India***Purpose**

The rice-wheat cropping system is pre dominant in Indo-gangetic plains and is the backbone of country's food security. The rice-wheat cropping system is labour, water, and energy-intensive and it becomes less profitable due to scarcity of labour and water and the problem is aggravated with deterioration of soil health, and emerging challenges of climate change. Therefore, a paradigm shift is required for enhancing the system's productivity. RCT involving zero tillage in wheat, direct seeding in rice, improved water- and nutrient-use efficiency, residue management to avoid straw burning, and crop diversification should assist in achieving sustainable productivity and allow farmers to reduce inputs, maximize yields, increase profitability and conserving natural resources. These technical interventions are site specific and depend on soil type, crop cycle, location, land holding and availability of market etc.

PROBLEMS OF RICE WHEAT CROPPING SYSTEM:

Declining water availability: Rice grown by traditional practices requires approximately 1500 mm of water during a season. The demand for water is being met through overexploitation of groundwater, leading to a decline in the water table. This has resulted in an increasing number of submersibles as the centrifuge pumps are no longer effective in pumping water. The cost of installing tubewells as well as the electricity consumption to pump water has increased several-fold (Chauhan *et al.*, 2012).

Deteriorating soil health: The RW system has not only resulted in mining of major nutrients (N, P, K, and S) from the soil but also has created a nutrient imbalance, leading to deterioration in soil quality. One ton of wheat grains is estimated to remove 24.5, 3.8, and 27.3 kg N, P, and K, respectively, whereas similar production of rice grains removes 20.1 kg N, 4.9 kg P, and 25.0 kg K.

Crop residues burning: Straw burning results in loss of 80% nitrogen, 25% phosphorus, 21% potassium and 4 - 60 % sulphur and gaseous emission of about 70 % CO₂, 7 % CO, 0.66 % CH₄ and 2.09 % N₂O. The burning also causes severe air pollution which severely affects human and animal health and also increases greenhouse gas (GHG) emission and results in global climate change (Kumar *et al.*, 2020).

OPPORTUNITIES AND STRATEGIES

Conservation Agriculture: The conservation agriculture is an innovation process of developing appropriate conservation agriculture implements, crop cultivars, etc., for iterative guidance and fine-tuning to modify crop production technologies. The details of individual conservation agriculture-based crop management technologies are described below (Gathala *et al.*, 2010).

Zero tillage: Zero tillage gives higher yield, reduces tillage cost, improves soil fertility, profitability and resource use efficiency, reduces wear and tear of tractors, reduces weed density and resulted in saving of time, fuel consumption and energy requirements,

The furrow-irrigated raised-bed system (FIRBS): The FIRBS reduced tillage and direct seeding on permanent beds reduce the costs of labor, diesel, and machinery, saving up to 30-40% of irrigation water in wheat and rice, reduced seed requirement and increased opportunities for crop diversification.

Direct-seeded rice: In recent years, declining water tables, increasing labor shortage, and deteriorating soil health make the RW system uneconomical and unsustainable. DSR resulted in similar or higher outputs, with 25% less water and labor and timeliness in planting.

Crop Residue Management: Crop residue management provides multiple benefits including improvement of physical, chemical and biological properties. It also results in suppression of weeds, soil moisture conservation, improvement of soil quality, reduces evaporation and conserve water for plants, reduces maximum soil temperature, retains moisture, increases water use efficiency and productivity and reduces the risk of soil erosion.

Precision Land Leveling: Laser land leveling is one of the few mechanical inputs in intensively cultivated irrigated farming that meets the objectives of saving irrigation water (10-25%), improved input-use efficiencies, and achieving a better crop stand (Jat *et al.*, 2010).

Crop Diversification: Inclusion of certain crops in sequential and intercropping systems has been found to reduce nutrient and water needs and the population of some obnoxious weeds to a considerable extent, thereby reducing herbicide needs to a great extent. Inclusion of legumes in cropping systems has been found to be effective in reducing water requirement and improving soil fertility.

Conclusions:

Rice-wheat cropping system is under pressure to fulfill the increasing food needs of the rising population mainly because of degradation in natural resources, decreasing labor availability, changing economic obligations and impact on environment. There is an urgent need for a technological breakthrough to sustain productivity in the region. Efforts are needed to improve nutrient-use efficiency and total factor productivity by maintaining or improving soil health, making crop residue management more efficient, and improving water-use efficiency.

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Molecular marker assisted breeding and development of *Bombyx mori* bidensovirus (BmBDV) (Lepidoptera: Bidnaviridae) resistant *Bombyx mori*.L (Lepidoptera: Bombycidae) hybrids suitable for varied climatic conditions.

K S Tulsi Naik^{*1}, M S Ranjini², A Ramesha¹, K M Ponnuel¹, K Rahul³, Mihir Rabha³, Lakshmanan Velusamy³, A R Pradeep³, B T Sreenivasa⁴, V Sivaprasad¹, R K Mishra¹

^{*1}*Seri Biotech Research Laboratory, Kodathi, Bangalore-560035*

²*Central Sericultural Research and Training Institute, Mananthavadi, Srirampura, Mysuru, Karnataka 570008*

³*Central Sericultural Research and Training Institute, Berhampore, West Bengal-742101*

⁴*Central Silk Board, Bangalore-560068*

Purpose

Sericulture has been one of the main branches of agriculture in Asiatic countries since hundreds of years. Like any other lepidopterans, the silkworms are also prone to pathogens especially viruses. Among the viruses *Bombyx mori* nucleopolyhedrovirus (BmNPV) and *Bombyx mori* densovirus (BmDNV) now named as a *Bombyx mori* Bidensovirus (BmBDV) are the major prevalent viruses. During the rainy season especially between July-December the incidences of, *Bombyx mori* bidensovirus (BmBDV) causing viral flacherie disease has been observed and can bring down cocoon productivity upto 20%. From the reports it is identified that the *nsd-2* protein in *Bombyx mori* codes for 12 transmembrane domains that acts as an amino acid transporter and virus utilizes this region for their entry into the host. However, in resistant breeds it encodes for only first 3 trans-membrane domains due to 6kbp deletion which eliminates exons 5–13 thus preventing the entry of virus. The resistance to BmBDV is governed by the recessive *nsd-2* deleted allele in homozygous condition. The *nsd-2* gene (non-susceptibility to densovirus-2), which happens to be/which is a putative BmBDV receptor is identified to be involved in resistance under recessive mutation condition. Consequently, screening and development of silkworm breeds for BmBDV resistance by artificial inoculation may not work as the *nsd-2* resistant allele is in heterozygous condition. Deletion in *nsd-2* gene is associated with the BmBDV resistance and hence this mutated sequence can be used as a molecular marker for the selection/identification of silkworm breeds that possess the mutated *nsd-2* region. Silkworm breeds with *nsd-2* resistant allele in heterozygous/homozygous condition can be identified and selectively bred through marker assisted breeding.

Methods

The *nsd-2* gene (non-susceptibility to densovirus-2) was utilized as functional gene marker to develop BmBDV resistant productive silkworm breeds through Molecular marker assisted breeding.

Results

From our study, we found that the productive and popular breeds such as CSR2, CSR4, CSR17, CSR50 and CSR27 carried the susceptible allele alone whereas, the breeds CSR6, CSR26, SK6, SK7, and J2P carried the resistant allele in heterozygous condition in some individuals. The commercially reared hybrids especially FC1xFC2 (double hybrids) are susceptible to BmBDV infection and therefore, genetic resistance through selection and introgression of resistant gene into parents followed by development and evaluation of hybrids is essential to prevent the crop loss due to BmBDV. In productive breeds like CSR6-R, CSR26-R (parents of FC1), SK6-R, SK-7R the individual male and female moths were checked for the presence *nsd-2* resistant alleles in homozygous condition, because in these breeds the resistant alleles are already present in either

homozygous or heterozygous condition. However, in CSR2 and CSR 27, parents of FC2 the resistant alleles are completely absent, therefore both the breeds were introgressed with donor parent J2P through back cross breeding. The individual male and female moths (sibmated BC4 F1 individuals) possessing nsd-2 resistant alleles in homozygous condition were identified and subjected to bioassay. Further, the BmDENV-2 resistant productive breeds like CSR6-R, CSR26-R, CSR2R and CSR 27 R (FC1xFC2 parents) popular in southern India and SK6, SK7, popular breeds in the West Bengal & North eastern regions were validated for resistance to BmDENV-2 through bioassays and confirmed the absence of viral genome at molecular level, thereby demonstrating complete resistance of developed breeds upon BmDENV-2 infection.

Conclusions

The resistant accessions developed through molecular marker assisted selection can be exploited in silkworm breeding program for developing BmBDV resistant hybrids.

Evaluation of weed management practices in soybean-gram sequence in organic situation under irrigated condition

Chavan A. A., Narkhede W. N., Mane S.G, Karle A. S. and Gokhale D. N

Department of Agronomy, College of Agriculture, Vasantrya Naik Marathwada Krishi Vidyapeeth, Parbhani-431 402, Maharashtra, India

Introduction

Weeds are widely reported as key constraint in organic agriculture. Soybean-gram is important cropping sequence adopted in Maharashtra state in irrigated condition. Both the crop faces severe weed competition during early stage of crop growth, resulting in loss of yield. The indiscriminate use of herbicide has resulted in loss of biodiversity, environmental and health problems. In organic situation cultural and mechanical methods are necessary to break the weed cycle. Now a days residue free food requirement is high, So keeping this point in view present investigation was carried out.

Objectives

To evaluate cultural and mechanical weed management practices in soybean-gram sequence in organic situation under irrigated condition

Methodology

Field experiments were conducted at Experimental Farm of AICRP on Integrated Farming System, Vasantrya Naik Marathwada Krishi Vidyapeeth, Parbhani (Maharashtra) during *Kharif* and *Rabi* seasons of 2017-18 and 2018-19. The experiment was laid out in randomized block design with three replications and include 10 treatments i.e T₁ - Two hand weeding at 20-25 and 45-50 DAS, T₂ - One hoeing 20-25 DAS + one hand weeding at 45-50 DAS, T₃ - Soybean + Sunhemp incorporation after 35-40 DAS in *Kharif* and Gram + Safflower (2:1) in *Rabi* season, T₄- Stale seed bed + reduced spacing + 2 tonne of wheat straw + one hand weeding at 25 DAS, T₅- Soil mulch at the time of sowing + one hand pulling at 25 DAS, T₆- Incorporation of neem cake 1.5 t/ha 15 days before sowing + one hand weeding at 25 DAS, T₇-Soil solarization with 25 u polythene mulch during summer + one hand weeding at 25 DAS, T₈- Mulching with straw, T₉- Weed free and T₁₀ -Weedy check.

Results

The Predominant weed flora in soybean crop were *Cynodon dactylon*, *Brachiaria eruciformis*, *Commelina benghalensis*, *Cyperus rotundus*, *Phyllanthus niruri*, *Parthenium hysterophorus* and *Euphorbia geniculata*. The predominant weed flora in gram crop were *Cynodon dactylon*, *Cyperus*

rotundus, *Phyllanthus niruri*, *Convolvulus arvensis* and *Amaranthus viridis* during both the years of investigation

In pooled data (2017-18 and 2018-19), in both soybean and gram crop at 20 and 40 DAS, significantly lower dry matter and higher weed control efficiency of monocot, dicot and total weeds were recorded by weed free treatment followed by T₇ (Soil solarization with 25 μ polythene mulch during summer + one hand weeding at 25 DAS) and T₄ (Stale seed bed + reduced spacing + 2 tonne of wheat straw + one hand weeding at 25 DAS). Significantly higher dry matter of monocot, dicot and total weeds recorded in weedy check (T₁₀) (Table 1 and 2).

During both the years, significantly higher soybean equivalent yield of system was recorded by T₄ (Stale seed bed + reduced spacing + 2 tonne of wheat straw + one hand weeding at 25 DAS) which was at par with soybean + sunhemp incorporation after 35-40 DAS in *Kharif*, and gram + safflower (2:1) in *Rabi* season. Soybean + sunhemp incorporation after 35-40 DAS in *Kharif* and gram + safflower (2:1) in *Rabi* season recorded significantly higher net returns and B:C ratio of system which was at par with stale seed bed + reduced spacing + mulching with wheat straw (2 t/ha) + one HW at 25 DAS and significantly superior over rest of the treatments. Lower soybean equivalent yield and net returns was observed with T₁₀ (Weedy check) (Table 3).

Conclusion

In organic agriculture, soybean + sunhemp incorporation after 35-40 DAS in *Kharif* and gram + safflower (2:1) in *Rabi* season recorded higher net monetary return and B:C ratio of the system followed by application of stale seed bed with reduced spacing and mulching with 2 tonne of wheat straw along with one hand weeding (25 DAS).

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Vis-NIR spectroscopy based rapid and non-destructive method for quantification of microplastics contamination in soil

Namita Das Saha^{1*}, Priyanka Kumari¹, Bappa Das², R. N Sahoo³, Rajesh Kumar⁴, Bhupinder Singh¹, Niveta Jain¹

¹Division of Environment Science, ICAR-Indian Agricultural Research Institute, Pusa, New Delhi, India

² ACR-Central Coastal Agricultural Research Institute, Goa, India

³ Division of Agricultural Physics, ICAR-Indian Agricultural Research Institute, Pusa, New Delhi, India

⁴ Division of Agricultural Chemicals, ICAR-Indian Agricultural Research Institute, Pusa, New Delhi, India

Purpose

Microplastics (MPs) have drawn the attention of the scientific fraternity of the globe. It has been identified as the second most important environmental issues. There is ample number of routes of entry for MPs in agricultural soil which potentially can enter into the food chain and thus a detailed study on possible MPs contamination in agricultural soil should be initiated without any further

delay. But there is no standardized extraction methods from soil for MPs, commonly accepted within the scientific community. The embedded errors, biases in the adopted methodologies can pose serious problems regarding the comparability of different studies and which ultimately leads to under or over estimation of MPs present in soil samples. With this research gap, present study was formulated to develop an efficient method for MPs analysis suitable for a wide range of soil matrices including organic matter matrices *viz.*, sludge (being major source of MPs in farm soil) and FYM.

Methods:

A method based on Vis-NIR (Visible-Near Infra Red) spectroscopy is developed for four different soil matrices belonging to Alfisol, Inceptisol, Mollisol and Vertisol and above mentioned two different organic matter matrices.

Results:

The developed method was found to be rapid, robust, reproducible, non-destructive, cheap and accurate method for estimation of all three-density groups of MPs (Low, Medium and High) with a prediction accuracy ranging from 1.9 g MPs/kg soil (Vertisol) to 3.7 g MPs/kg soil (Alfisol). Two different regression models namely Partial Least Square Regression (PLSR) and Principal Component Regression (PCR) were assessed and PLSR was found to provide better performance in terms of prediction accuracy and minimum quantification limit. However, PCR performed better for organic matter matrices (FYM and sludge) than PLSR. The method avoids any complicated sample preparation steps except drying and sieving thus saving much time and acquisition of reflectance spectrum for each sample is possible within 18 seconds with three replications.

Conclusions:

Owing to have the minimum quantification limit ranging from 1.9-3.7 g/Kg soil, this vis-NIR based method is perfectly suitable for estimation of MPs in soil samples collected from plastic pollution hotspots like landfill sites, regular based sludge amended farm soils. Additionally the method can be adapted by small scale compost industries for assessing MPs load in produced FYM and city compost which are applied at agricultural fields and will be helpful in reducing possible MPs at the sources itself.

Keywords: Microplastics, Soil, Rapid method, Quantification, PLSR, PCR, Vis-NIR Spectroscopy

Assessment Of Variability And Change In Rainfall Over Maharashtra (Western India) During 1901-2020

Sukanya M. Khese¹, Rahul S. Todmal²

¹*Post Graduate Teaching & Research Centre, Department of Geography, S. P. College, Pune, Maharashtra 411030, India*

²*Department of Geography, Vidya Pratishthan's Arts, Science & Commerce College, Baramati, Pune, Maharashtra 413133, India*

Purpose

The study investigates the spatial and temporal changes and variability in annual and monsoon rainfall over the state of Maharashtra for time period of 120 years with the application of basic statistical techniques and various indices including Rainfall Anomaly Index (RAI) and Seasonality Index (SI).

Various facets of rainfall impacting agriculture, ground water, vegetation, natural disasters etc. will be assessed which will further improve the tracking and prediction of recurrence of extreme events, change in seasonality and shift of monsoon period (months).

Methods

The study considered five time slots of 30 years each to understand the changes in rainfall during different climate regimes between 1901 and 2020. The timeslots classified were 1901-1930, 1931-1960, 1961-1990 and 1991-2020. Trends in RAI and SI were analysed by linear regression and Mann-Kandell (parametric and non-parametric tests, respectively). To confirm the changes in rainfall, paired t test was applied. Monthly and seasonal averages were calculated to check for the inter-seasonal, intra-seasonal and monthly changes according to the timeslots in each district. Variability of the rainfall data was evaluated using coefficient of variability (CV) to check for the deviation from normal rainfall for all four timeslots (temporal variation) for each district (spatial variation).

Results

It is observed that almost 45% of districts registered rise in rainfall (June to October) between 20% and 45% during 1991-2020 with respect to 1901-1930. Notably, the Kolhapur District observed with highest increase of about 80%. On the other hand it also suggests that the districts from Vidarbha experienced decline in rainfall by -1% to -12%. The annual and monsoon rainfall reveal increase in RAI over 64% and 70% of the area, respectively. During monsoon, >25% rise in rainfall variability was observed in 1931-1960 over 14% area of Maharashtra which increased up to 48% area in 1991-2020 using Coefficient of variability, revealing rapid increase in climate vulnerable region in Maharashtra. On the other hand, about 85% of the districts exhibit an increase in SI during 1901-2020. However, 30% of them are statistically significant. Rainfall in the recent past (1991-2020), about 90% of the study area is characterized by markedly seasonal with a long drier season.

Conclusions

Rising anomalous behavior and increasing seasonality of rainfall, points towards more extreme rainfall clustered in few months. This is a major concern from the agricultural and water resources viewpoint as, the uneven distribution of rainfall within a season or year may cause hydro-climatic disasters (flood and drought). Water conservation and storage practices during monsoon can help cope up water scarcity situation during rest of the year due to clustered rainfall. Proper actions and planning is expected from agriculturists, hydrologists and government policy makers to sustain this situation and ensure resilient agriculture and society.

Keywords: Rainfall Anomaly Index, Seasonality Index, Mann-Kendall test

Effect of Bio-stimulants on Growth and Yield of Mustard

Neha Gangwar, A.Yadav, A. Arunachalam, S. Garg, A. Ram, Rajul Gupta and B. Alam

ICAR-Central Agroforestry Research Institute, Jhansi

Purpose

Recently, application of plant bio-stimulants on crop plants have emerged as a cost-effective technique for increasing the input use efficiency, inducing crop tolerance to abiotic stresses, and enhancing the quality of food grains. Indian Mustard (*Brassica juncea* M.) is most important oil seed crop grown in north India which provide majority of cooking oil, but crop experience varying levels of nutrient and water stress throughout the crop cycle. Therefore, we tested the effect of different bio-stimulants on the growth and yield of Mustard.

Methods

An experiment was laid out in randomized block design with three replications at the Research Farm of ICAR-Central Agroforestry Research Institute, Jhansi, during rabi season 2022-23. Eight treatment combinations involving two Bio-stimulants i.e. CAD More Liquid (Botanical extract, including seaweed extract), CAD Grow Liquid (Humic acid and fulvic acid and their derivatives) and four concentrations of each were tested on mustard crop in Bundelkhand.

Results

The application of bio-stimulants significantly improved the plant growth, yield and yield attributes mustard crop. Both the bio-stimulants were found very effective in improving the growth and yield parameters resulting significant increase in grain yield of mustard compared to the control. The grain straw ratio was also higher with use of bio-stimulants.

Conclusions

The results revealed that application of bio-stimulants resulted better growth and grain yield of mustard compared to control indicating that bio- stimulants can be important in increasing crop yield and sustaining farmer's income.

Keywords: Bio-stimulants, Fulvic acid, Humic acid, Seaweed , Mustard

Effect of Bio stimulants on Growth and Yield of Pea (*Pisum sativum*. L)

Rajul Gupta*, Ashok Yadav, N. Gangwar, S. Garg, A. Arunachalam, A. Ram and B. Alam

Objective

Innovations and technologies are fundamental to improving the overall sustainability of the production system and enhancing the quality and safety of the product. Recently, plant bio-stimulants have emerged as promising tools for improving input efficiency, enhancing crop tolerance to abiotic stresses, and enhancing fruit quality. Thus, we tested the effects of different bio stimulant products on pea growth and yield.

Methods

Different bio stimulants i.e. including CAD Grow Granules (Humic acid and fulvic acid and their derivatives), Nutricomplete/Amicad (Protein hydrolysates and amino acid) were tested on pea under semi-arid conditions of Bundelkhand region.

Results

Using bio stimulants improved plant growth characteristics (plant height, spread, and leaf parameters), flowering, fruiting, and yield parameters. The yield of all bio stimulants applied treatments was higher than the control. As compared to the control, all treatments showed almost higher fruit set ratios. However, all treatments have not been characterized by phytotoxicity, flower drop, or disease incidence.

Conclusions

The findings demonstrated that all bio stimulants improved pea growth and output when compared to controls, demonstrating that bio stimulants can significantly contribute to boosting farmers' revenue in a long-term manner.

Keywords: Bio stimulants, fulvic acid, humic acid, protein hydrolysates, Pea (*Pisum sativum*. L)

Occupational stress among sanitary workers**Roopa Kurbett and Geeta Chitagubbi***Department of Family Resource Management, College of Community Science, University of Agricultural Sciences, Dharwad, Karnataka.***Purpose**

Stress at work is the consequence of combined exposure to the magnitude of factors in the work environment. Stress is the most common psychological condition arising from the various components of the job. Stress at work may disturb his sleep, just as stress at home may affect his work. Prolonged stress no matter where it has been aroused, do not allow man to work efficiently. Sanitary workers are more susceptible occupational groups for occupational stress illiteracy, poverty, unplanned life styles and lack of knowledge to cope with the stress are the commonest factors producing stress among them.

Methods

The study was carried out from period October 2021 to October 2022. A total 150 municipal sanitary workers were interviewed and examined. The study was conducted in (HDMC) Hubli – Dharwad Municipal Corporation based on purposive random sampling technique. A self-structured interview schedule comprising socio-demographic factors and questions on various aspects of occupational stress was framed. Results were analysed using SPSS-13.0.

Results

Almost 66.67% of the sanitary workers had moderate to high occupational stress and also seen that the severity of stress level decreased with increase in education status and it increased as duration of service increased. Majority (77.33%) of the workers worked for more than 10 years. Powerlessness (99.33%), strenuous working conditions and unprofitability (84.00%) and intrinsic impoverishment (74.00%) as the predominant sub-scales in the high occupational stress index (OSI) group.

Conclusion

In present study, moderate to severe level of stress was observed. The socio-demographic factors influenced the occupational stress index.

Keywords:Sanitary workers, occupational stress, stress and health.

**Studies on peach budding in stool beds of 'Rubira' rootstock
Preetika Verma^{1*}, Naveen C Sharma¹, Pramod Verma, Uday Sharma and Sandhya***Dr. YSPUHF, Nauni, Solan, Himachal Pradesh***Purpose**

Peach (*Prunus persica* L. Batsch) is commonly propagated by tongue grafting. 'Rubira' peach rootstock multiplied through mould layering becomes unsuitable for tongue grafting at the end of season due to excessive diameter of stool shoots forced to go for cleft grafting, which lead to reduction in graft take success. However, this rootstock can be budded in stool beds during summer or rainy season of the same year when the thickness of the rootstock is appropriate for budding to produce a budded plant within one year. The aim of the study was to standardize the ideal method and time of summer budding in peach in stool beds of 'Rubira' rootstock for higher bud take success and production of saleable budded plants within the same season.

Methods

The experiment was laid out during 2020-21 in a Randomized block design (Factorial) with three budding methods (chip, shield and patch beddings) performed at five different timings at 15-days interval between 22nd May and 21st July. There were total 15 treatment combinations which were replicated three times. The observation on survival percentage, plant height, number of leaves per plant, root-shoot biomass and saleable plants were recorded as per standard procedures during the course of investigation.

Results

A significantly higher survival percentage (100%) was recorded in chip budding performed on 21st June followed by 6th June (96.67%) and 22nd May (93.33%). The patch budding performed on 21st June and 6th July and shield budding performed on 6th July also exhibited 100 per cent bud take success. The chip budding performed on 22nd May also exhibited highest plant height (167.37 cm), number of leaves per plant (128.87) and root-shoot biomass (106 g). However, maximum number of saleable budded plants (93.33%) was obtained in shield and patch budding performed on 6th June but it was closely followed by chip budding performed on 22nd May.

Conclusions

Chip budding performed during 22nd May and 6th June was proved to be the best methods and time for budding of peach on 'Rubira' rootstock in the stool beds to produce quality nursery plants within one year on the basis of bud take success of more than 90 per cent and significantly higher growth of budded plants.

Keywords: Peach, Rubira, bud take and plant growth

Effect Of Rooting Media And Time Of Planting On Hardwood Cuttings Of Kiwifruit Pratibha Thakur^{1*}, Dharampaul S Sharma¹, Vishal S Rana and Neerja Rana

Dr. YSPUHF, Nauni, Solan, Himachal Pradesh

Purpose:

Kiwifruit (*Actinidia deliciosa* Chev.) commonly propagated by hardwood cuttings. Availability of quality planting material is the first and foremost priority for commercializing any fruit crop. The type of cutting and season of planting have great influence on the ability of rooting of cuttings. Time of planting plays important role in the growth and development of any fruit crops. Optimum planting date has become a main factor for proper growth of cuttings. Besides season and type of cutting, rooting media also have profound influence on the ability of rooting of cutting in kiwifruit. Selecting a good growing medium is very important for quality and healthy root system. The aim of the study was to standardize the ideal rooting media and time of planting for cuttings of kiwifruit.

Methods

The experiment was laid out in Randomized Block Design (RBD) Factorial with three replications having ten treatments of different growing media viz; Sand – 2", Sand – 3", FYM – 2" + Sand – 2", FYM – 3" + Sand – 3", Cocopeat – 2" + Sand – 2", Cocopeat – 3" + Sand – 3", Sand – 2" + Poultry manure – 2", Sand – 3" + Goat manure – 2", Mixture 2" [Sand + FYM+ Cocopeat (1:1:1)] and Control (Soil) and three different dates of planting viz; 22nd January 2020, 29th January 2020 and 8th February. The observation on sprouting, shoot length, number of leaves, leaf area, fresh and dry shoot weight, rooting percentage, number of adventitious roots and total root length, were recorded as per standard procedures during the course of investigation.

Results

The results revealed that maximum sprouting percentage (88.22 %) was obtained with rooting media Cocopeat – 3" + Sand – 3" planted on 8th February. The highest (203.25 cm) shoot length was recorded in cutting planted in growing media Sand - 3"+ Goat manure - 2" on 8th February which was statistically at par with (202.50 cm) growing media Cocopeat - 3" + Sand - 3" and planted on 29th January which was statistically higher than other treatment combinations. And maximum (33.33) number of leaves were recorded in cuttings planted in rooting media Sand - 2" + Poultry manure - 2" planted on 8th February. The maximum (195.64 cm²) leaf area, fresh shoot (98.51 g) weight and dry shoot weight (43.04 g) were recorded in growing media Cocopeat - 3" + Sand - 3" on 8th February. The maximum (73.33 %) per cent rooting and had maximum (34.67) number of adventitious and highest (10.23 m) root length were recorded in cuttings planted in rooting media Cocopeat - 3" + Sand - 3" on 8th February.

Conclusions

On the basis of the results obtained in the present study, it is inferred that cuttings planted on 8th February in growing media Cocopeat - 3" + Sand - 3" was found the best media combination for making rooting in cuttings of kiwifruit

Keywords: Cutting, rooting media, planting time

Impact of intervention of biomass stove technology on women health

Shilpa Channalli P. and Renuka S. Salunke

Department of Family Resource Management, College of Community Science, University of Agricultural Sciences, Dharwad. 580005, Karnataka, India.

Purpose

Indoor carbon emission is the presence of particles such as dust, dirt or toxic gases in indoor air and it is the degradation of indoor air quality by harmful chemicals and other materials. The impact of increased levels of indoor carbon emission caused due to traditional cookstove in the rural households. A comparative assessment of the impact of traditional cookstoves and biomass stoves coupled with the type of kitchen was conducted to estimate the carbon emission concentrations in the rural kitchen area.

Methods

The study was conducted from October 2021 to September 2022 at Timmapur village of Dharwad district, Karnataka in India. The selected indoor carbon emissions like CO₂, CO, PM_{2.5} and PM₁₀ were measure through Air Quality Monitor and CO meter while before cooking hours, during cooking hours and after cooking hours in the kitchen during both morning and evening cooking sessions. The indoor carbon emission and health status of the women were measured before intervention of traditional cookstove and after intervention of biomass stove.

Influence of the two types of kitchens, i.e., enclosed and semi-enclosed was also comprehensively analyzed to measure its impact on the indoor air quality.

Results

The study highlighted that deployment of biomass stoves would help in improving the indoor air quality of the kitchen area by resulting in reducing the concentrations of CO₂, CO, PM_{2.5} and PM₁₀ by 22–40 per cent, 21–46 per cent, 20–40 per cent and 15–39 per cent respectively and also women's health problems were reduced by 15.6–33.30 per cent. It was also highlighted that the type of kitchen significantly influences the accumulation of carbon emission, demonstrated by the results that the indoor air quality being worst in the case of enclosed kitchen. Regression models

were highly significant positive correlation between before and after intervention of indoor carbon emission and cooking hours in kitchen.

Conclusion

Thus, the usage of biomass stove coupled with efficient designing of the kitchen can improve the overall indoor air quality of the household along with immense health benefits.

Keywords: Indoor carbon emission (CO₂, CO, PM_{2.5} and PM₁₀), traditional cookstoves, biomass stoves and health problems.

Immunogenic Evaluation of Bacterially expressed recombinant Hemagglutinin receptor binding domain (HA1) of H1N1 virus in Swiss Albino mice model for possible vaccine candidate

Arshi Siddiqui^{1,2}, Ashish Kumar Yadav¹, Ram Kumar Nema³, Roji Khan¹, Debasis Biswas³, Nidhi Tripathi², Anil Prakash⁴, Jagat R Kanwar¹ and Rashmi Chowdhary^{1*}

¹Department of Biochemistry, All India Institute of Medical Sciences Bhopal, 462024, Madhya Pradesh, India.

² Department of Biotechnology, Barkatullah University, Bhopal--462026, Madhya Pradesh, India.

³Department of Microbiology, All India Institute of Medical Sciences Bhopal, 462024, Madhya Pradesh, India.

⁴Department of Microbiology, Barkatullah University, Bhopal--462026, Madhya Pradesh, India

Purpose

The recurring worldwide spread of H1N1 underscored the importance of developing effective vaccines against pandemic influenza viruses as soon as possible. However the effectiveness of Influenza vaccines depends on how closely the circulating strain matches the vaccine strain. In order to develop effective vaccine candidate for Indian population, we selected the donor HA sequence from Central Indian circulating strain. Because bacterial protein expression is less expensive, and the sequence utilized was from a circulating Madhya Pradesh strain, the goal of this investigation was to bacterially expressed HA1 derived from A/Bhopal/AS 1008/2019(H1N1) to induce neutralizing antibodies in Swiss Albino mice model.

Methods

In the present study, HA1 gene of Influenza A virus (A/Bhopal/AS_1008/2019(H1N1)) MZ735580 was cloned in pJet/1.2 vector. The pJet /1.2 vector was digested and the released insert was sub cloned in pTriEx 4 expression vector. After confirmation of cloning, it was transformed in bacterial host BL-21 for protein expression. It was induced by IPTG. The cell pellet after induction was lysed and subjected to SDS and western blotting. Recombinant HA1 protein was purified and mixed with alum adjuvant to form suspension. It was then injected in six 6-8 week old female Swiss Albino mice by giving two doses of 50µg each with the interval of 14 days. The indirect ELISA was performed for confirmation of production of anti HA1 antibodies in mice serum.

Results

HA1 gene of Influenza A virus (A/Bhopal/AS_1008/2019(H1N1)) MZ735580 was successfully cloned in pJet/1.2 vector and sub cloned in pTriEx 4 expression vector. The positive results of SDS PAGE confirmed the expression in induced culture. The ELISA results demonstrated the production of anti HA1 antibodies in mice serum. Antibody production shoots up after second dose.

Conclusions

The findings of the immunogenic response of HA1 in mice model were compelling; nevertheless, additional optimization using a large number of mice and diverse species such as rabbit, guinea pig, and so on is necessary for use of recombinant HA1. The viral challenge and vaccination experiments with rH1N1HA1 will provide more evidence of cross protection. This research is a first step towards development of indigenous vaccine according to circulating strain in Madhya Pradesh, India. Present study will be definitely the basis for development of HA1 based vaccine candidate belonged to Madhya Pradesh, India and will contribute in Self Reliant India.

Keywords: hemagglutinin, influenza, antigenic variation, antibodies, vaccine and swiss albino

Role of impaired energy metabolism in cytotoxic effects of *Solanum nigrum* extract on breast cancer cells

Haseeb A. Khan¹, N. Rajendra Prasad², Amani A. Alghamdi¹, Salman H. Alrokayan¹, Basma S. Almansour³

¹Department of Biochemistry, College of Science, King Saud University, Riyadh 11451, Saudi Arabia

²Department of Biochemistry & Biotechnology, Faculty of Life Sciences, Annamalai University, Annamalai Nagar, India

³Department of Pharmaceutical Chemistry, College of Pharmacy, King Saud University, Riyadh, Saudi Arabia

Purpose

Recent studies have shown that many natural agents have the potential to target cancer cells by damaging their mitochondrial function. *Solanum nigrum* is a widely used medicinal herb in traditional medicine. We investigated the cytotoxic effect of water extract of *Solanum nigrum* (SNWE) in breast cancer cell lines.

Methods

The breast cancer cell lines including MCF-7 and MDA-MB-231 were cultured and exposed to SNWE at various concentrations. To explore the role of energy metabolism, we analysed the cellular adenosine triphosphate (ATP) levels and mitochondrial membrane potential (MMP) using spectrophotometry and fluorescence microscopy, respectively.

Results

The IC₅₀ values of SNWE in MCF-7 and MDA-MB-231 cells were found to be 4.2 µg/ml and 5.3 µg/ml, respectively. The 24, 48, and 72 h treatment at 100 µg/ml SNWE showed 0.85 ± 0.07 nM, 0.38 ± 0.1 nM and 0.20 ± 0.1 nM ATP in MCF-7 cells and 0.94 ± 0.07 nM, 0.84 ± 0.2 nM and 0.46 ± 0.2 nM in MDA-MB-231 cells, respectively. The SNWE treatment altered the MMP in a concentration-dependent manner in both the breast cancer cell lines when compared with healthy mitochondria.

Conclusions

The cytotoxic effects of *Solanum nigrum* water extract against breast cancer cells are mediated by energy metabolism, which was evident by impaired MMP and depleted ATP levels. Further studies are warranted to investigate the anticancer effects *Solanum nigrum* using animal models of breast cancer.

Keywords: *Solanum nigrum*, mitochondrial dysfunction, energy metabolism, breast cancer

Efficacy Of Green Synthesized Silver Nanomaterials In Wastewater Treatment Of Byramangala Reservoir, India**Usha, C., Nandini, N., Kumar, M.***Department of Environmental Science, Bangalore University, Bengaluru-560 056***Purpose**

Water is a crucial natural resource essential for human survival and a valuable national asset. Unfortunately, water is becoming increasingly scarce. The management of water resources is a growing global concern, and India is particularly vulnerable to water scarcity due to population growth, economic development, rising demand, undisciplined lifestyles, and water pollution. Implementing scientific planning, development, and management practices to address this issue is crucial. Therefore, this study aims to employ bio-nanofiber to treat wastewater from Byramangala Reservoir.

Methods

The standard methods prescribed by The American Public Health Association (APHA), 2017, were utilized to analyze the physicochemical characteristics of the wastewater before and after treatment.

Results

After analyzing the treatment efficiency of the wastewater from Byramangala Reservoir, it was found that the green synthesized silver nanoparticles were able to reduce the levels of several contaminants. Specifically, the treatment resulted in a 95% reduction in Total Dissolved Solids, a 92% reduction in Electrical Conductivity, an 88% reduction in Calcium Hardness, an 86% reduction in both BOD and Chlorides, an 81% reduction in Alkalinity, an 82% reduction in Sodium, a 75% reduction in Nitrates, and a 73% reduction in Potassium.

Conclusion

The use of silver nanomaterials, which are prepared using plant extracts, has become a promising tool for treating wastewater. This plant extracts function as both reducing and stabilizing agents for silver ions, facilitating the formation of nanoparticles well-suited for wastewater treatment. The present study has shown that green synthesized silver nanomaterials using plant extracts demonstrate a high removal efficiency for a wide range of pollutants found in wastewater. Overall, the use of silver nanomaterials prepared with plant extracts presents a promising solution for wastewater treatment. However, additional research is required to fully comprehend their effectiveness, potential hazards, and long-term effects on the environment.

Keywords Absorbent, nanomaterials, pollutants, wastewater, water demand.

Growth and Gonadal development comparison between Common Carp and Amur Common Carp**G. Vidya Sagar Reddy*, M. Shyam Prasad, P. Shanthanna, G. Ravi and B. Raveender***Fisheries Research Station, PVNR Telangana Veterinary University, Palair – 507 157, Khammam Dt., Telangana***Purpose:**

Common carp (*Cyprinus carpio*) though suitable for Culture in the Freshwater Aqua Farm Ponds of Telangana and highly preferred by the consumers; they are not growing to marketable size in a short time like the Indian Major Carps. Therefore, there is a need for propagation of Alternate Fish to Common Carp suitable for culture in Aqua Farm Ponds.

Methods:

Amur Common Carp (*Cyprinus carpio haematopterus*) as an alternate to Common Carp (*Cyprinus carpio*) was selected for its suitability to Culture in the Aqua Farm Ponds over a period of 180 days with studies on the Growth Performance and Gonadal Development changes. Common Carp and Amur Common Carp Fingerlings were stocked in the Experimental Ponds at the rate of 300 No's per 200 m² area of Pond with an average weights of 20.65 ±0.30 grams and 20.50 ±0.40 grams; average lengths of 10.8 cm and 11.0 cm respectively and fed with De-oiled-Rice Bran (DORB) and Ground Nut Oil Cake (GNOC) at the rate of 5% of the body weight initially for a period of 2 months and gradually reduced to 3% of the body weight.

Result:

At the end of 180 days culture period, an average body weight of 540 ±5.20 grams was recorded in Amur Common Carp Fish compared to Common carp (294 ±4.50 grams body weight). During the culture period, low FCR (2.1 ±0.30), high average Daily Growth (2.47 ±0.40 grams/day) and high Survival Rate (90%) were noted in Amur Common Carp compared to Common Carp (FCR: 3.2 ±0.20, Average daily growth: 1.3±0.50 grams/day and Survival Rate: 80%). Delayed maturation was identified in the Amur Common Carp with the Gonadosomatic index (GSI) not exceeding 2.1%. On the other hand the maturation was faster in Common Carp with the GSI being more than 10.3% of the body weight.

Conclusion:

The study reveals that the Amur Common Carp Fish performed consistently Superior Growth with late maturation compared to Common Carps, which is one of the most influencing factors to augment more production within short culture period for the benefit of the Fish Farmers. Amur Common Carp Fish Culture was economically viable compared to Common Carp.

Keywords: Common Carp, Amur Common Carp, Growth Performance, Gonado-somatic Index, FCR, Alternate Fish

Functional modulation in bovine monocyte-derived macrophages during thermal cum lipopolysaccharide stress challenge

Rajamanickam Kandasamy¹, Visha Pasuvalingam² Elango Ayyasamy³ and Leela Venkatasubramanian⁴

1 Department of Veterinary Physiology and Biochemistry, Veterinary College and Research Institute, Salem, Tamil Nadu, India – 636 112.

2- Department of Veterinary Physiology and Biochemistry, Veterinary College and Research Institute, Salem, Tamil Nadu, India – 636 112.

3 - Veterinary College and Research Institute, Salem, Tamil Nadu, India – 636 112. 4 - Professor and Head, Department of Veterinary Physiology, Madras Veterinary College, Chennai, Tamil Nadu, India -600 007.

Purpose:

Domestic cattle with standard body size quickly reach their heat tolerance limit and are prone to heat stress. Incidence of diseases in bovines is positively correlated to THI as a result of alteration in their primary immune response. Macrophages are often considered the sentries in innate immunity, which functions both under normothermia and during periods of body temperature elevation. The combined effects of high temperature and endotoxemia on bovine monocyte-derived macrophages remain almost undisclosed. This study aims to unravel the molecular and

functional responses of bovine monocyte-derived macrophages to thermal cum lipopolysaccharide induced stress challenge in vitro.

Method:

Bovine monocyte-derived macrophages were cultured from the whole blood collected from six multiparous non-pregnant adult cattle and cells were incubated at 37 °C or 40 °C with lipopolysaccharide (1.0 µg/mL) for 24 hrs and 48 hrs. At the end of each treatment, cell viability, apoptotic rate, mitochondrial membrane potential, oxidative activity, phagocytosis, and autophagy functions were assessed and mRNA abundance of genes related to heat shock (HSP 70), inflammation (IL1β, IL6, IL 12, TNF, INF γ), cell signalling (TLR4), cell viability (Bax, Bcl2), nitric oxide synthesis (NOS2) and natural resistant associated macrophage protein were quantified by quantitative polymerase chain reaction (qPCR).

Result:

The results revealed the increased apoptosis ($P < 0.001$), reduced mitochondrial membrane potential ($P < 0.001$), and reduced cell viability ($P < 0.05$), decreased oxidative and phagocytosis ability ($P < 0.05$) in cells co-stimulated with LPS and thermal stimuli. Upregulation ($P < 0.001$) of HSP 70 gene and downregulation ($P < 0.001$) of natural resistant associated macrophage protein, cell signalling, and inflammation related genes mRNA expressions were also identified due to these stressors.

Conclusion:

In conclusion, the observed thermal cum LPS stress induced dysregulation in macrophage functionality may be one facet of the increased disease susceptibility in dairy cattle during thermal stress.

Keywords: Bovine, Endotoxin, Heat stress, Immune function, Macrophage

Nutrient Availability of Banana (*Musa spp.*) Growing Soil Influenced by Bio-fertilizers

Bhagyaresha R. Gajbhiye , Sujata V. Dhutraj and Ramprasad N. Khandare

College of Agriculture, Vasant Rao Naik Marathwada Krishi Vidyapeeth , Parbhani-431402, India

Purpose

With changing scenario of banana production, efficient nutritional management system needs emphasis for reduced cost of production and increased productivity. Bio-fertilizers play very significant role in improving soil fertility by fixing atmospheric nitrogen, both in associations with plant roots and without it, solubilize insoluble soil phosphates and produce plant growth substances in the soil. The microorganisms like *Azospirillum*, *Azotobacter*, phosphate solubilizing bacteria, sulphur oxidizing culture etc. have proved to be very useful in crop production.

Nutrient demand for banana production is high as it removes large quantity of nutrients from soil for its growth development and yield. Due to rising cost of chemical fertilizers and its adverse effect on soil health and productivity needs balanced fertilization. To increase the productivity and soil health application of bio-fertilizers is consider for the study.

Methodology

The research trial was carried out at Banana Research Station, Nanded (M.S.), VNMKV, Parbhani, India during 2019-20 to 2021-21 to find out the effect of biofertilizers on soil physico-chemical properties, nutrient availability and leaf nutrition of banana (*Musa spp.*) cv. Grand Naine . The experiment was planned in randomized block design with nine treatments i. e. T₁- 100% RDF (Control), T₂- 75% RDF + Soil application of *Trichoderma harzianum* , T₃- 75 % RDF + Soil

application of *Azospirillum*, T₄- 75 % RDF + Soil application of PSB, T₅- 75 % RDF + Soil application of *Trichoderma harzianum* + *Azospirillum* + PSB, T₆- 100 % RDF + Soil application of *Trichoderma harzianum*, T₇-100 % RDF + Soil application of *Azospirillum*, T₈- 100 % RDF + Soil application of PSB and T₉-100 % RDF + Soil application of *Trichoderma harzianum* + *Azospirillum* + PSB which replicated three times.

Available nitrogen was determined by alkaline potassium permanganate method by using Microkjeldahl's apparatus (Subbiah and Asija, 1956). Available phosphorus was extracted from the soil with 0.5 M sodium bicarbonate (pH 8.5) as an extractant and measured colorimetrically by using 420 nm wavelengths as described by Olsen *et al.* (1954). Available potassium was determined by neutral normal ammonium acetate method on flame photometer (Jackson, 1973). Available Fe, Zn, Mn and Cu content of soil were determined from the extract using Atomic Absorption Spectrophotometer, as described by Lindsay and Norvell (1978).

Result

The highest available N (189.72 kg ha⁻¹) P (17.23 kg ha⁻¹), K (660.43 kg ha⁻¹), Available Fe (5.33 mgkg⁻¹), Zn (1.51 mgkg⁻¹), Cu (3.56 mgkg⁻¹) and Mn (5.61 mgkg⁻¹) were recorded maximum with application 100% RDF + Soil application of *Trichoderma harzianum* @ 25 g plant⁻¹ + *Azospirillum* @ 25 g plant⁻¹ + PSB @ 25 g plant⁻¹ which was found to be at par with treatments 75 % RDF + Soil application of *Trichoderma harzianum* + *Azospirillum* + PSB during both the year of study. Further, it was showed that all the available nutrients were increased than the initial values of nutrients in banana growing soil.

Conclusion

The highest soil nutrient availability and leaf nutrient content of banana were observed with the treatment 100% RDF + Soil application of *Trichoderma harzianum*@25 g plant⁻¹ + *Azospirillum*@25 g plant⁻¹ + PSB@25 g plant⁻¹.

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Effect of Different Biostimulants on Growth and Yield of Strawberry Cv Winter Dawn
Ashok Yadav, A. Arunachalam, S. Garg, N. Gangwar, A. Ram, Rajul Gupta and B. Alam
ICAR-CAFRI Jhansi, U.P.

Purpose

The new innovations and technologies are essentially required to improve the overall sustainability of the production system with enhancement in the quality and safety of the produce. In the recent past, plant bio-stimulants have emerged as promising production tools for increasing the use efficiency of inputs, promoting crop tolerance to abiotic stresses, and enhancing the quality of fruit products. Therefore, we tested the effect of different biostimulants products on the growth and yield of strawberry.

Methods

Total five products belonging to different classes of biostimulants i.e. CAD More Liquid (Botanical extract, including seaweed extract), CAD Grow Liquid (Humic acid and fulvic acid and their derivatives), CAD Grow Granules (Humic acid and fulvic acid and their derivatives), Nutricomplete/Amicad (Protein hydrolysates and amino acid), CAD Grow Powder/Flakes (Humic acid fulvic acid and their derivatives) were tested on winter dawn cultivar of strawberry under semi-arid conditions of Bundelkhand region.

Results

The use of biostimulants significantly improved the plant growth characteristics (plant height, spread, leaf parameters), flowering, fruit, and yield parameters of the crop. All biostimulants applied treatments showed higher yield compared to the control. The fruit set ratio was almost higher in all the treatments compared to the control. However, phytotoxicity, flower drop, and disease incidence have not been observed in all treatments.

Conclusions

The results revealed that all five biostimulants showed better growth and yield of strawberry compared to control indicating that biostimulants can play a pivotal role in increasing farmer's income in a sustainable way.

Keywords: Biostimulants, fulvic acid, humic acid, protein hydrolysates, strawberry, seaweed

Evaluation of strawberry at different farmers' fields under semi-arid region of Bundelkhand Sandeep Garg, Ashok Yadav, A. Arunachalam, Rajendra Prasad, Prashant Singh, A. Shukla, N. Gangwar, Rajul Gupta and B. Alam

ICAR-CAFRI Jhansi, U.P.

Purpose

The Bundelkhand region is characterized by difficult biophysical and socioeconomic conditions, including atypical weather patterns and the challenges associated with related land degradation. Furthermore, overuse resulted in a reduction in the quality of the ecosystem's natural resources. In such circumstances, the region's overall agricultural production is very less, highly uncertain, or unstable. To improve income, dietary security, and environmental security, we introduce new potential crops i.e. strawberry which has a high nutritional value and provide higher return quickly.

Methods

The present investigation was carried out in three villages, namely Badora, Maheshgarh and Nahora of Babina Block of Jhansi district. Babina is situated approximately 98 m above mean sea level and at 25.78 °N and 81.5 °E in the southern part of Uttar Pradesh. Occasional spell of frost and precipitation are quite common during winter season. Tissue cultured plants of Winter dawn variety of strawberry were planted on the raised beds having dimension of 90 cm width and 15 cm height, and length depended upon the availability of space in different fields. Strawberry plants were planted at a distance of 45cm × 30 cm.

Results

The plant height of strawberries cultivated in different farmers' fields ranged from 19.61 to 24.67 cm; plant spread i.e. E-W varied from 24.71 to 36.43 cm and plant spread i.e. N-S varied From 24.71 to 38.33 cm. Significant variation in different fruit parameters i.e. the total number of fruits (35.60 to 67.2), fruit length (26.47 to 53.33 mm), fruit width (22.07 to 41.67 mm), fruit weight (10.71 to 56.46 g) and TSS (7.24 to 10.34⁰ Brix) was observed at different farmers' fields. The average mean of total Fruit, fruit length, fruit width, fruit weight and TSS recorded were 52.10

nos., 38.43 mm, 34.78 mm, 23.36g and 8.66 °Brix, respectively. The total yield of king size, medium size and small size of fruits of strawberry cultivated in different fields ranged from 108.84 to 845.91, 261.50 to 1007.00 Kg and 200.07 to 870.28 Kg, respectively. The total yield of Strawberry fruit cultivated in different fields ranged from 670.41 to 2723.19 Kg, and the total income ranged from Rs. 99240.24 to 577058.40.

Conclusions

The present investigation into the evaluation trial of strawberry cv. Winter dawn revealed that strawberry cultivation can be a viable option for the farmers of Babina block of Jhansi district by replacing their traditional crops and enhancing their income through strawberry cultivation.

Key words-: Strawberry, Mulching, Planting material and Crop performance

Analysis of changes in hydro-meteorological variables using Mann- Kendall and Sen's slope tests in the Jaipur city, Rajasthan, India

Nitin Singh Kachhawa¹, Arbaaz Aziz Shaikh¹, Prasit Girish Agnihotri¹, K. A. Jariwala¹, Azazkhan I. Pathan²

¹Department of Civil Engineering, Sardar Vallabhbhai National Institute of Technology, Surat, Gujarat, India

² IIT Gandhinagar, Gujarat, India

Purpose

Climate change has been a prominent issue in the last decade. Climate change on a global scale does not necessarily have the same effect in different regions. Study of trends of hydro-meteorological variable reveals the effects of climate change. The main purpose of this study is to obtain a better understanding of the temporal variability and trends of hydro-meteorological variables in the Jaipur city, Rajasthan, India. The present study is focused on the analysis of the trends in hydro-meteorological variables at a regional scale over 31 years (1991–2021).

Methods

The literatures related to detection of trend in precipitation, temperature and specific humidity using non-parametric tests around the globe were reviewed. The five hydro-meteorological variables like precipitation, specific humidity, mean temperature, maximum temperature and minimum temperature were collected from NASA POWER website for the Jaipur city, Rajasthan, India. The non-parametric distribution free Mann-Kendall and Sen's slope methods were used to determine whether there was an increasing or decreasing trend in hydro-meteorological data with their statistical significance using R programming language.

Results

The Mann-Kendall and Sen's slope methods was performed annually and seasonally (Winter, occurring from December to February, Summer or pre-monsoon season, lasting from March to May, Monsoon or rainy season, lasting from June to September, Post-monsoon or autumn season, lasting from October to November) at 5% significance level. The positive and negative trend were identified. The results obtained from both tests are compared.

Conclusions

In general, the results of using the Mann-Kendall and Sen's slope tests demonstrated the good agreement of performance in detection of the trend for hydro-meteorological variables. The analysis further reveals that the concern variation in hydro-meteorological variables trend and slope magnitude is attributed to climate change phenomenon in the region.

Keywords: Hydro-meteorological variables, Mann-Kendall test, Sen's slope test, Jaipur city

Quality Analysis of Oil Contents in Cultivars of *Cymbopogon* Under Organic Management in Bundelkhand**Neha Gangwar, Rambir Singh***Bundelkhand University***Purpose**

Medicinal and aromatic plants are cultivated mainly as an alternative source of income to small and medium farmers. Essential oil of (*Cymbopogon citratus*) lemongrass is one of the most important oils for commercialization. *Cymbopogon citratus* is widely used in nutraceutical industries due to its strong lemony odour for its high content of the aldehyde citral and small quantities of geraniol, geranyl acetate and monoterpene olefins. The information on quality of essential oils of lemongrass under organic management is not available. Therefore, present attempt was made to study quality of essential oils in lemongrass in Bundelkhand.

Methods

The different varieties of lemongrass was planted at the agriculture field of Bundelkhand University under organic management. They were harvested at different time intervals after planting for extraction and yield estimation of essential oil and quality of essential oil was analyzed by GC/MS.

Results

The yield of essential oil varied significantly in different cultivars. The essential oils were analysed using GC/MS instrument and identified different components. The major components identified were geraniol (citral-a), neral (citral-b), caryophellene and limonene in lemongrass essential oils.

Conclusions

The higher content of major compounds in oil revealing better quality of oil. Therefore, such studies may be undertaken on other aromatic crops.

Keywords: *Cymbopogon citratus*, GC/MS, Citral, Caryophellene, limonene, geraniol, geranyl acetate and monoterpene olefins

Multi-decadal Change detection in the vegetation of Western Uttarakhand using Remote Sensing data**Aditi Ahlawat and Arijit Roy***Disaster Management and Studies Department**Indian Institute of Remote Sensing (IIRS)**Indian Space Research Organization (ISRO)**4-Kalidas Road, Dehradun - 248001, Uttarakhand, India***Purpose**

This paper aims to investigate the vegetation changes in the Western Uttarakhand region over a period of three decades (1991-2021) at seven different elevation levels using the Normalized Difference Vegetation Index (NDVI), a widely-used remote sensing product that serves as a proxy of vegetation health. The study utilizes GIS software tools and techniques to analyze and interpret the satellite data, in order to provide insights into the spatiotemporal patterns of vegetation dynamics in the study area. The results of this study could potentially aid in informed decision-making related to the conservation and management of natural resources in the region.

Methods

Google Earth Engine was used for data acquisition and pre-processing of Landsat 5TM and Landsat 7 ETM+ satellite data for the period 1991 to 2021. Bands used for the present study from both datasets have a spatial resolution of 30 m and a temporal resolution of 16 days. The NDVI was calculated for the growing season (March-April-May) of 1991, 2001, 2011 and 2021. These datasets for three decades were then analysed for vegetation change using a change detection tool available in Erdas Imagine 2016 at seven different altitude levels generated from NASA SRTM DEM at 30 m spatial resolution.

Results

At altitudes lower than 1000 m, there was a small increase in NDVI during 1991-2021. However, there was an increase of 30 km² area under declining NDVI during the same period. At 3000-4000 m, the area quantified for decreasing NDVI was found to be 11% during 2011-2021 which was 24% during 1991-2001. At the same altitude level, there was a substantial increase in NDVI during 1991-2011, which later decreased during 2011-2021 indicating less vegetation growth. At altitude higher than 4000 m, area under increasing NDVI, increased from 3% during 1991-2001 to 21% during 2011-2021. Areas with an altitude of more than 5000 m showed a significant increase of 25% during 2011-2021 from 10% during 1991-2001.

Conclusions

Overall, there has been an increase in vegetation cover from 1991 to 2021 in the western Uttarakhand region. with a maximum increase present in the higher elevation levels of more than 4000 m. This growth can be attributed to increased warming at particularly higher altitudes which in turn favour the greening of the regions.

Keywords: Climate Change; NDVI; Uttarakhand; Multi-decadal analysis, DEM

Variability, Heritability and Genetic Advance studies in the Indigenous and Exotic accessions of Okra (*Abelmoschus* spp.) under Konkan conditions of Maharashtra
JastiSrivarsha^{1*}, V.V.Dalvi², S.G.Bhave³, S.S.Desai⁴, M.S.Joshi⁵, A.V.Mane⁴, S.V.Sawardekar²

¹*National Horticultural Research and Development Foundation, Nashik, Maharashtra.*

²*Department of Agricultural Botany, D.B.S.K.K.V., Dapoli, Maharashtra.*

³*D.B.S.K.K.V., Dapoli, Maharashtra.*

⁴*Department of Agricultural Botany, D.B.S.K.K.V., Dapoli, Maharashtra.*

⁵*Department of Plant Pathology, D.B.S.K.K.V., Dapoli, Maharashtra.*

Purpose

Changing climatic conditions like drought, unseasonal rainfall, heat stress is posing a serious threat to the productivity of okra by effecting the crop growth, production and productivity. One of the sustainable approaches to reduce the effects of climate change on crop growth and development is to develop climate-resilient varieties.

Methods

Keeping this in view, twenty six genotypes of okra including indigenous and exotic lines were evaluated for fourteen yield and yield attributing traits during summer 2018 in randomized block design with three replications at Education and Research Farm, Department of Agricultural Botany, College of Agriculture, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Ratnagiri, Maharashtra, India.

Results

The analysis of variance (ANOVA) revealed significant differences for all the fourteen traits under study suggesting the existence of required genetic variation in the breeding material. Higher PCV and GCV estimates were recorded by plant height, fruit length, fruit yield per plant, shoot and fruit borer incidence on fruits, number of fruits per plant and yellow vein mosaic virus percent disease incidence. Moderate PCV and GCV was registered by fruit weight, internodal length, fruit diameter, number of nodes at first flowering, days to initiation while days to 50 % flowering, number of locules per fruit and number of ridges per fruit recorded low PCV and GCV. High to very high heritability (broad sense) was observed for all the traits except number of ridges per fruit, number of locules per fruit and individual fruit weight. These three traits registered moderate heritability.

Conclusion

High Genetic Advancement as percent of mean was recorded by some of the traits except internodal length, fruit diameter, number of nodes at first flowering, fruit weight, days to initiation, number of ridges per fruit, number of locules per fruit and days to 50 % flowering. The presence of variability in the germplasm evaluated helps in progressing the elite genotypes to utilise in breeding programme.

Keywords: climate-resilience, yield, germplasm, okra

Mitigating Climate Change through Sustainable Soil Management: Impact of Municipal Solid Waste Compost on Wheat Root Attributes and Soil Biological Properties

Subhradip Bhattacharjee*, and Rakesh Kumar

Agronomy Section, ICAR- National Dairy Research Institute, Karnal, Haryana, India-132001

Purpose

This research aimed to investigate the impact of various compost amendments on wheat root characteristics and soil biological properties under two soil moisture scenarios.

Methods

The experiment was conducted at Agronomy Research Farm of ICAR- National Dairy Research Institute in Karnal, India during the Rabi season in 2019-20 and 2020-21. Five treatments were evaluated under two soil moisture scenarios, and the data were pooled. Rhizosphere soil samples were collected from each plot and analyzed using standard procedures. Root parameters were evaluated by following standard procedures described in the literature. The study was aimed at examining the impact of compost amendments on soil biological properties and plant root growth under different soil moisture conditions. The standard procedures were followed to ensure accurate and reproducible results.

Results

Continuous compost addition for four years significantly influenced the plant root-soil enzyme and soil moisture levels. The application of 10-ton MSWC with 100% RDF resulted in better wheat root characteristics and improved soil enzyme activities in comparison to the control and FYM treatments under both moisture sufficient and scarce scenarios. The addition of compost also led to decreased glutathione reductase activity and increased antioxidant activity.

Conclusion

In conclusion, it was found that 10-ton MSWC with 100% RDF is an effective treatment for improving soil biological properties and plant root growth. The utilization of municipal solid waste compost could be a cost-effective substitute for farmyard manure. This research could be beneficial in identifying sustainable techniques for enhancing soil health, particularly in areas where farmyard manure is scarce.

Keywords: municipal solid waste compost, soil health, root growth, wheat, antioxidant, enzyme

Change in Cropping System: An Adaptation Strategy for Cyclone affected Coastal West Bengal

Amitava Panja*, Siddhesh Zade, Sanchita Garai, Sanjit Maiti

Dairy Extension Division, ICAR-National Dairy Research Institute, Karnal, Haryana, India-132001

Purpose

In recent years, an increase in the frequency and strength of cyclones has posed the greatest threat to coastal West Bengal, which has seen an increase in cyclone frequency and intensity. This threatens agriculture, which fuels the region's economy and is dominated by smallholder farmers, who are particularly vulnerable to the threat. Farmers have used a multitude of adaptation measures to combat climate change, with a shift in land use pattern being one of the most significant.

Methods

The study was conducted in two blocks, namely Contai-I and Ramnagar-I, in the coastal district of Purba Medinipur, West Bengal. In the context of climate disasters caused by cyclones, this study intended to analyze qualitatively the viewpoints of smallholder farmers and the evolution of land use patterns over time. Experts and stakeholders were consulted during the

questionnaire's development. Focus group discussions and individual interviews were utilized to collect data.

Results

A Majority of respondents (70 %) viewed shifting from a paddy-based agricultural system to a vegetable and fish-based cropping system as one of the most important resilience strategies. In addition to the direct effects of the cyclone, the flooding of rice fields with saline water and the intrusion of salinity have posed a threat to paddy cultivation, increased costs, and decreased net revenue. Short period vegetable cultivation was observed to be profitable. Farmers have also begun to alter their land use pattern for fisheries, such as freshwater (mixed with vegetable production by land shaping) and brackish water pisciculture (consisting primarily of shrimps). Respondents viewed this adaptation method as more profitable than rice-based agriculture in the context of regional climate change. Extension contact, farmer-to-farmer extension, number of climatic disasters, and proportionate income contributed considerably to cropping system transformation as a main climate change adaptation strategy in coastal regions.

Conclusions

Change in cropping system has evolved as one of the most adopted adaptation strategies in response to cyclone-led climate disasters in coastal West Bengal. Shifting from paddy based cropping system to vegetable and fish based cropping system has also comparative advantage in farmer's net income.

Keywords: Land Use Pattern, Cropping System, Climate Change, Smallholder farmers, Coastal region

Effect of fertilizers on growth and flowering of African marigold cv. 'Pusa Narangi Gainda' under Jhansi conditions of Bundelkhand

Priyanka Sharma, Gaurav Sharma & Y. Bijilaxmi Devi

Rani Lakshmi Bai Central Agricultural University, Jhansi

Purpose:

Marigold is one of the important loose flower crop grown all over India under open field conditions. It is offered in religious places, used for making garlands, for extraction of flower pigments, as trap crop and for controlling nematodes in soil. Aim of this study was to standardize the dose of NPK for quality and high yield of marigold flowers.

Methods:

An experiment was carried out to study the effect of nitrogen, phosphorus and potassium on growth and flowering of African marigold cv. 'Pusa Narangi Gainda' during 2021-22 under Jhansi conditions of Bundelkhand region. Fertilizer treatments consisted of three doses of nitrogen i.e. 50 kg/ha, 100 kg/ha and 150 kg/ha, two doses each of phosphorus and potassium i.e. 50 kg/ha and 100 kg/ha alongwith control. There were 13 treatment combinations viz. T₀ (Control), T₁ (N₅₀P₅₀K₅₀), T₂ (N₅₀P₁₀₀K₅₀), T₃ (N₅₀P₅₀K₁₀₀), T₄ (N₁₀₀P₅₀K₅₀), T₅ (N₁₀₀P₁₀₀K₅₀), T₆ (N₁₀₀P₅₀K₁₀₀), T₇ (N₁₀₀P₁₀₀K₁₀₀), T₈ (N₁₅₀P₅₀K₅₀), T₉ (N₁₅₀P₁₀₀K₅₀), T₁₀ (N₁₅₀P₁₀₀K₁₀₀), T₁₁ (N₁₅₀P₅₀K₁₀₀) and T₁₂ (N₁₅₀P₁₅₀K₁₅₀).

Results:

Tallest plants of African marigold cv. 'Pusa Narangi Gainda' (55.56 cm) were recorded with application of 150 kg/ha each of nitrogen, phosphorus and potassium. As regards plant spread and stems per plant, these were recorded maximum (53.33 cm and 7.67 respectively) with application of 150 kg/ha nitrogen and 100 kg/ha each of phosphorus and potassium. However, flowers per stem were recorded maximum (7.62) with application of 150 kg/ha nitrogen and 50 kg/ha each of phosphorus and potassium. Higher flowers per plant (47.95) were maximum with application of 150 kg/ha nitrogen and 100 kg/ha each of phosphorus and potassium. Similarly, flower yield per plant and flower yield per hectare (556.06 g and 15.87 t/ha) were

also recorded maximum with application of 150 kg/ha nitrogen and 100 kg/ha each of phosphorus and potassium.

Conclusion:

From this it can be concluded that fertilizer dose consisting of 150 kg nitrogen and 100 kg each of phosphorus and potassium is optimum for getting better flower yield in African marigold cv. 'Pusa Narangi Gaiinda'.

Keywords: African marigold, Bundelkhand, Fertilizers, Nitrogen, Phosphorus, Potassium

Melatonin treatment extends harvesting period, enhances yield and quality in litchi

Kilchira M. Marak^a, Hidayatullah Mir^{a*}, Preeti Singh^a, Wasim Siddiqui^b and Tushar Ranjan^c

^aDepartment of Horticulture (Fruit & Fruit Technology), ^bDepartment of Food Science and Postharvest Technology, ^cDepartment of Molecular Biology and Genetic Engineering Bihar Agricultural University, Sabour-813210, Bhagalpur, Bihar

Purpose

Litchi (*Litchi chinensis* Sonn.) is very important evergreen subtropical fruit of high commercial value in global market. In the past few decades, the demand of litchi fruits has soared to new heights both in national and international markets. However, litchi production and marketing are still limited due to its relatively small growing region owing to its specific climatic requirements, brief harvesting period, highly perishable fruits and pericarp browning. Keeping in view these major concerns the present investigation entitled "Insights into the role of melatonin in improving yield, quality and shelf life of litchi cv. Purbi".

Methods

Influence of different concentration of melatonin as pre-harvest spray (0.1mM and 0.5mM at 10, 40 and double spray at 10 and 40 days after fruit set) and post-harvest treatment (0.1mM, 0.25mM and 0.5mM) was observed on harvesting period, yield, quality and shelf life of litchi fruits cv. Purbi. Expression profiling of genes linked to pericarp browning for post-harvest treatments was also done.

Results

The ripening of melatonin treated fruits were delayed by 11 days at 0.1mM concentration when sprayed at 10 days after fruit set and 2 days at 0.5mM concentration. Significant enhancement in yield and yield attributing traits like fruit weight and pulp weight was also observed in melatonin treated fruits and it was highest in trees and fruits sprayed with 0.1mM melatonin at 10 days after fruit set. Higher quality attributes were also observed in fruits of melatonin treated trees than the untreated ones. TSS, ascorbic acid, total sugar, total anthocyanin, total phenolic content and antioxidant levels at harvest were recorded highest in fruits of trees sprayed with 0.1mM melatonin after 10 days of fruit set.

Conclusions

The results suggest that pre-harvest melatonin treatment could be a useful tool to extend harvesting period of litchi fruits along with an increase in crop yield as well as fruit quality traits at harvest.

Keywords: Litchi, Shelf Life, Melatonin, Pericarp Browning,

Characterization of *Arabidopsis* Cyclin-Dependent Kinase regulatory subunit-2 function under different abiotic stresses

Abhishek Kanojia¹, Ritu Yadav¹, Arpana Katiyar¹, Yashwanti Mudgil^{1*}

¹Department of Botany, University of Delhi

Purpose

Climate change impacts the weather patterns, which leads to increase in the cases of weather extremities. Drought, floods, cold-heat waves condition events have increased rapidly in last decades. The unfavourable environmental conditions lead to stress in plants. In the stress environment, plant growth and development get impacted. At cellular level, these stresses modulate the rate of cell division by influencing the cell cycle. Cyclin Dependent Kinases (CDKs) in plants are one of the major proteins playing important role in regulation of cell cycle. CDKs belong to family of serine/ threonine protein kinases. CDKs are regulated by many different proteins in the cells. One of the major class of regulators are Cyclin-Dependent Kinase regulatory subunits which can modulate the CDK's activity in both positive or negative way and hence can modulate cell cycle. In current study we have performed detailed *in silico* expression analysis of *Arabidopsis* CKS2 and its interactome during different development stages and under different abiotic stresses. We are also using yeast as a model to study stress related functions of CKS2. We are hoping this will provide us vital information regarding regulation of cell cycle related genes under stress conditions and in long run would help scientific community in designing strategies towards crop improvement programs.

Methods:

In the present study, we have carried out comprehensive *in-silico* expression analysis of *CKS2* and its interactome in various developmental tissues and under different stress conditions using eFP browser. We are also in the process of analysing stress related functions of *CKS2* using yeast growth assays on different abiotic stress conditions.

Result and Conclusions

Much information is not available on CKS proteins in plants; present study is an initiative towards finding the roles of CKS proteins and their interactors in different stages of development and growth as well as during different stress conditions. We hope outcome of our current study will be helpful in generation of new information on cell cycle dependent stress responsive pathways.

Utilization Of *Moringa Oleifera* (Sahjan) Leaves As Valuable Food Ingredient In Nachos (Maize Chips) Preparation

Shifat Fatima**, Arvind Kumar Srivastava*

** , Department of Food and Nutrition, ERA University, Lucknow

*Faculty of Sciences, ERA University, Lucknow

Purpose

The present study aims on incorporating *Moringa* leaves as dietary supplement into maize chips to fortify the food product with enriching nutrients for boosting immunity , curing diseases and restoring health and can further be utilized for areas unexplored . *Moringa oleifera* leaves can be proved to have potential to cure diseases.

Methods

Four products with different concentration of *Moringa* leaves powder were made (0%,10%,20%,30%).0% concentration being taken as control. All the products were assessed for their organoleptic qualities using hedonic rating scale .Best product was assessed for nutritional properties (energy, carbohydrate, protein, fat)

Results

20% *Moringa oleifera* leaves powder incorporated Nachos score best in the organoleptic evaluation. Nutritional analysis of the same product revealed Energy-350.72kcal/100 gm, carbohydrate-64.96 gm/100gm, protein-11.25gm/100gm, Fat-6.73gm/100gm, Iron-2.84mg/100 gm, calcium-274.72mg/100gm, vitamin c-4mg/100gm. Various other food products formulation of therapeutic efficacy can be made emphasizing on control and cure of various diseases. *Moringa oleifera* is widely used for the treatment of different ailments as it contain various bioactive components

Conclusion

Bioactive components of *Moringa oleifera* has been found effective in management of manifestation of variable ailments . Elaborative comprehensive studies need to be performed based on therapeutic intervention of *Moringa oleifera* and its product.

Keywords- *Moringa oleifera*, value added product development, organoleptic evaluation
Nutritional analysis

Geographical variations of Berberine content in *Tinospora cordifolia* accessions grown in various parts of Tamil Nadu

¹B.C. Akhilraj and ²Dr. J. Suresh

¹Department of Plantation, Spices, Medicinal and Aromatic Crops, Horticultural College and Research Institute, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India

²Coconut Research Station, Tamil Nadu Agricultural University, Aliyar Nagar, Pollachi, Tamil Nadu, India.

Purpose

The phytochemical composition of plants has been significantly impacted by the most recent shifts in the global climate. Secondary metabolite synthesis in flora is regulated genetically as well as by a variety of biotic and abiotic stressors. Plants respond significantly in terms of biochemical elements in various ecological niches to adapt to their surroundings. The chemical makeup of medicinal plants in these areas is impacted by the wide range of environmental conditions present at various elevations, which ultimately influences their survival.

Methods

In the current study, the effects of climate change on the behaviour as well as phytoconstituents of plant accessions of *Tinospora cordifolia* discovered in three distinct Tamil Nadu areas of India were considered. A total alkaloidal content estimate was followed by a high-performance thin layer chromatography (HPTLC) study of the main alkaloidal marker compound, berberine, to conduct phytochemical research.

Result

The study's findings showed various collections of *T. cordifolia* developed at medium altitudes (239m) in the Vellore region were found to contain a maximum quantity of berberine of 365.70 ng/gm of the extract, with the TCVL accession of the species having a greater total alkaloidal quantity in the plant found to be 13.5%.

Conclusion

Selecting the superior genotype for commercial farming of the species and figuring out the potential medicinal value of the plant can both benefit from an evaluation of the phytochemical profile carried out at various elevations.

Keywords: Berberine, HPTLC, Tamil Nadu, *Tinospora cordifolia*

The Modern Approach To Traditional And Herbal Medicines

Nidhi^{1*} and Garima Pathak²

1 Department of Botany, Patliputra University, Patna, Bihar- 800020, India. E-mail: nidhipatna23@gmail.com

2 Department of Botany, B. D. College, Patliputra University, Patna, Bihar- 800020, India.

Extended summary

Herbal medicine, referred to as botanical medicine or herbalism, involves the use of plants or parts of plants, to treat injuries or illnesses. Herbal medicines are the study or use of medicinal herbs to prevent and treat diseases and ailments or to promote health and healing. It is a drug or preparation made from a plant or plants and used for any of such purposes. Herbal medicines are the oldest form of health care known to mankind. Herbal medicines are chief fundamental in traditional medicinal system such as ayurvedic, homeopathic, neuropathic and other medicinal systems. There are numerous herbal products available that claim to treat the symptoms of a wide range of problems, from depression to cold and flu. Nearly 80% of the world population use herbal medicines and World Health Organisation (WHO) also encourages, recommends and promotes the inclusion of herbal medicines in national health care programs because such medicines are easily available at a price within the reach of common man and as such are time tested and thus considered to be safer than the modern synthetic medicines. For the past few decades, herbal medicines have been increasingly consumed by the people without prescription. Seeds, leaves, stems, bark, roots, flowers and extracts of all of these have been used in herbal medicine over the millennia of their use. Herbal formulations have reached widespread acceptability as therapeutic agents like antimicrobial, antidiabetic, antifertility, antiaging, antiarthritic, sedative, antidepressant, antianxiety, antispasmodic, analgesic, anti-inflammatory, anti-HIV, hepatoprotective, treatment of cirrhosis, asthma, menopause, migraine, gall stones, chronic fatigue, Alzheimer's disease and memory enhancing activities.

Advantages of herbal medicines:

Low cost

Strength and effectiveness

Better tolerance

More safety

Less side-effects

Ready availability

Ecofriendly

Disadvantages of herbal medicines:

Not able to treat sudden illness and accidents

Risk with self-dosing

Difficulty in standardization

Standardization of herbal medicines:

Since the herbal formulations are of mainly plant origin, they are susceptible to contamination from different sources, deterioration and variations of chemical composition. Therefore, to ensure the safety and efficacy of herbal medicines, standardization and development of quality control protocols for herbal medicines is extremely important. For the identification of medicinal plants and their constituents, WHO guidelines provide the fingerprinting methods to meet the global standards of quality control of the herbal formulations. Standardization in itself involves many parameters like gross morphology, microscopy, physical parameters, chemical fingerprinting, chromatographic fingerprinting, spectroscopic fingerprinting, DNA marker fingerprinting etc. The standardization of herbal drugs may give acceptance by worldwide moreover it improves the therapeutic efficacy and safety of the drugs.

Stability testing of herbal medicines:

Stability testing of herbal medicines is a challenging task, because the entire herb or herbal product is regarded as the active substance, regardless of whether constituents with defined therapeutic activity are known. The objective of a stability testing is to provide evidence on how the quality of the herbal products varies with the time under the influence of environmental factors such as temperature, light, oxygen, moisture or excipient in the dosage form, particle size of drug, microbial contamination, trace metal contamination and to establish a recommended storage condition and shelf-life. Stability testing is necessary to ensure that the product is of acceptable quality throughout its entire storage period. Stability studies should be performed on at least three production batches of the herbal products for the proposed shelf-life, which is normally denoted as long term stability and is performed under natural atmospheric conditions. With the help of modern analytical techniques like spectrophotometry, HPLC, HPTLC and by employing proper guidelines it is possible to generate a sound stability data of herbal products and forecast their shelf-life, which will help in improving global acceptability of herbal products.

Conclusion:

Medicinal herbs as potential source of therapeutics aids has attained a significant role in health care system all over the world for human beings not only in the diseased condition but also as potential material for maintaining proper health. It is clear that the herbal industry can make great strides in the world. With the increased use of herbal products, the future worldwide labeling practice should adequately address quality aspects. Standardization of methods and quality control data on safety and efficacy are required for understanding of the use of herbal medicines. It is an urgent requirement from the scientists all over the world that their contribution towards the development of new techniques and instruments by using concept of the traditional and modern methods.

Keywords: *Herbal medicines, Ayurvedic, Standardization, Stability testing, Spectroscopic fingerprinting.*

Molecular characterization of AGB1-NDL1 module under salt stress

Poonam Yadav, Nisha Khatri and Yashwanti Mudgil*

Department of Botany, University of Delhi, North Campus, New Delhi 110007

Purpose

Salt stress is a limiting environmental factor that inhibits plant growth and development. Role of AGB1 in salt stress has been well established using *agb1-2* mutant with the help of various biochemical and physiological experiments. G-protein subunit, AGB1 was found to be down-regulated by heat and cold, but up-regulated by salt stress treatment. In *Arabidopsis*, NDL1 protein was discovered in a screen for finding AGB1/AGG subunit interactors. Recent functional characterization of the AGB1-NDL1 module under salinity stress using mutant and overexpression lines of NDL1 and AGB1 has revealed that NDL1 works downstream of AGB1 and both work antagonistically. In current study, we aim to unravel the molecular mechanism and components of AGB1-NDL1 module's functioning involved in the salt stress responses.

Methods

Morphological and physiological phenotypes of AGB1 null mutant *agb1-2* seedlings in response to salt stress were studied using *in situ* histochemical localization of superoxide radicals and electrical conductivity measurement. Protein repertoire modulation in response to NaCl stress was studied using, two-dimensional gel electrophoresis (2-DE) and mass spectrometry (MS) analysis. The differential expression of 2DGE identified some selected proteins was further validated by semi-quantitative RT-PCR. Further *in-silico* expression profiling during salt stress and interactome analysis of selected molecular players were also

performed using online tools/public databases. Further *in-planta* interaction analysis of putative stress related interactors from NDL1 interactome using bimolecular fluorescence complementation (BiFC) is underway.

Results

Our study determines salt stress proteome profile of *agb1-2* mutant resulting in new insights into salt-responsive AGB1 dependent proteins. Also, *in-silico* expression analysis of all the identified genes shows distinct patterns of their expression in response to salt stress. The interactome analysis of 2DGE selected candidates indicates the functional association with the salt-responsive proteins. Also, *in-planta* validation of interactions between putative stress related interactors and AGB1-NDL1 module is in progress.

Conclusions

This study would help in further dissection of AGB1-NDL1 signalling module during salt stress. The salt stress related interactors identified in current study after rigorous analysis could be exploited for crop improvement programs for salinity stress management.

Keywords: AGB1- G-protein Beta subunit

NDL1- N-Myc Downregulated Like 1

2DGE- Two-dimensional Gel Electrophoresis

MS- Mass Spectrometry

RT-PCR– Reverse Transcription polymerase chain reaction

BiFC- Bimolecular fluorescence complementation

Morphophysiological and molecular marker based identification of heat tolerant egg plant under changing climate

Santhiya, S, Partha Saha*, Bhoopal Singh Tomar, Sarika Jaiswal, Gopala Krishnan S, Vishwanathan Chinnuswamy, Namita Das Saha and Chandrika Ghoshal**

Division of Vegetable Science, ICAR-Indian Agricultural Research Institute, New Delhi 110012

**ICAR-CTRIR Research Station Dinhat, Cooch Behar, West Bengal 736135, hortparth@gmail.com*

Purpose

The growth and development of crop plant depends on the surrounding environment where in atmospheric temperature plays a prominent role. In tropical countries, an increased temperature creates heat stress to plant and affects its growth and development. Intrinsic variation for high temperature tolerance might exist in promising egg plant genotypes that need to be explored. The changing climate scenario made necessary to develop heat tolerant varieties which perform well in heat stress conditions

Method

The present investigation was undertaken at the research farm of Division of Vegetable Science, ICAR- IARI, New Delhi. A total of 62 genotypes were evaluated for ten morphological, and 11 physiological and biochemical parameters. The data were subjected to statistical analysis using ANOVA, correlation, principle component analysis (PCA) and Hierarchical Cluster analysis (HCA) using SAS ver. 9.3. software. The genotypes were also characterized by 15 SSR markers and data was analysed using power marker software.

Results

The % fruit set was very high (95.45%) in *kharif* season as compared to summer season (82.23%). In summer season Pant Samrat had highest fruit set (82.23%). The highest yield per plant was observed in Guhala Chatua Local (1.8 kg) in summer season where as in case of *kharif* season yield per plant was maximum in Swarnamani (5.97 Kg). Based on yield performance, Pusa Shyamla, Guhala Chatua Local, DB-8, Pant Samrat and Pusa Ankur were selected as tolerant genotypes. The heat tolerant genotype Pant Samrat had high (57.2%) relative water content (RWC) in leaf and lower canopy temperature. The

total chlorophyll content was found higher in *khari* season and less in summer season. The Hydrogen peroxide content (H_2O_2), Malondialdehyde (MDA), Super Oxide Dismutase (SOD), Catalase (CAT) content was higher in summer season. H_2O_2 , MDA were higher in susceptible genotypes it was more as compared to tolerant genotypes whereas SOD and CAT were higher in tolerant genotypes. The first principal component (PC1) explained 48% of the variance and second principal component (PC2) could explain 14% of the variance. Marker analysis showed that, an average of 2.067 allele per locus was obtained among the 62 eggplant genotypes. Among the 15 polymorphic SSR markers, 67% markers had PIC value higher than 0.3, thereby suggesting their suitability for genetic diversity analysis. The NJ (Neighbour joining) dendrogram obtained by 15 SSR markers distributed 62 genotypes into seven major clusters.

Conclusion

The genotypes identified in the present study could be used in breeding program to develop heat tolerant hybrids in eggplant.

Keywords: Eggplant, heat, climate,

Gamma rays induced mutational variability in mango for tolerance to salinity stress

Nusrat Perveen^{a*}, M.R. Dinesh^a, M. Sankaran^a, K.S. Shivashankara^b, K.V. Ravishankar^b, R. Venugopal^c and Hidayatullah Mir^d

^aDivision of Fruit Crops, ^bDivision of Basic Sciences, ^cDivision of Social Sciences and Training, ICAR-Indian Institute of Horticultural Research, Hesaraghatta Lakepost, Bengaluru-560089, Karnataka

^dDepartment of horticulture (Fruit and Fruit technology), Bihar Agricultural University, Sabour, Bhagalpur, 813210, Bihar

Purpose

Polyembryonic mango genotypes are the best resources for development of mango rootstocks owing to the production of true-to-type nucellar seedlings with deep tap root system however their use in breeding programme is often limited by the narrow genetic base of these genotypes. Creation of variability in these polyembryonic genotypes using induced mutations for traits like salinity tolerance might make them more desirable to be used as rootstock.

Methods

Putative mutants generated through gamma irradiation of mango genotype Nekkare along with control seedlings were evaluated by comparing the compositions, relative proportions and inter-sample differences of their major volatile compounds using headspace-solid phase micro-extraction (HS-SPME) method coupled with gas chromatography-mass spectrometer. They were further characterized using SSR markers to ascertain the genetic diversity present in the samples under study.

Results

Monoterpenes were the most abundant volatile compound in all the studied samples out of which I-Phellandrene formed the major fraction in control seedlings while beta-Phellandrene was dominant in the selected putative mutant seedlings. Mother plants and control seedlings grouped together while the putative mutants grouped apart from the mother plants and control seedlings suggesting a genetic diversity. Further, evidence that the mutation caused variability in the treated population is supported by the high allelic richness and mean Shannon's Information of the putative mutant population of nucellar origin and hence, similar to mother plants.

Conclusions

This study proposes that volatile profiling and SSR markers can be used as a tool to detect variance in a mutant population and the former can be utilized to validate putative mutants.

Keywords: Mango; Mutation; Gamma Rays; Polyembryony; SSR markers; Volatile profiling

Development of HPLC based method for Phospholipids analysis in milk
Akshay Ramani^{1*}, Raman Seth², Vivek Sharma², Rajan Sharma²

Dairy Chemistry Division, ICAR-National Dairy Research Institute, Karnal, Haryana, India.

Purpose

Phospholipids gained increased interest in the past decade because of their numerous health benefits. They affect cell functions such as growth, molecular transport system, memory processing, stress responses, and central nervous system myelination. Phospholipids have antioxidative, antimicrobial, and antiviral properties, in addition to instrumental roles as secondary messengers for cell signaling, regulation, and growth. Due to the amphiphilic nature of phospholipids, their quantitative analysis is not straightforward. HPLC has emerged as the most powerful technology for phospholipid analysis. Most reported HPLC methods uses ELSD, CAD, or MS detectors. They are not generally available in all food testing laboratories for routine analysis. Therefore, the optimized a HPLC-UV based simple method for quantification of the major phospholipids in milk.

Methods

In this study, we extracted phospholipids from milk using a folch (chloroform: methanol), mojonier (petroleum ether, diethyl ether, ammonia) and tertiary amine (N, N-dimethylcyclohexylamine) method for comparative study. HPLC method optimized using HILIC column (ReproSil 150 mm × 4.6 mm × 5 μm) with UV detector.

Results

Phospholipids isocratic separation of was achieved on silica gel column using elution solvent mixture of acetonitrile: (methanol: ammonium acetate (70:30)) 90:10 v/v within 15 min, flow rate: 1.5 ml/min, oven temperature: 40°C. Detection of phospholipids was attained by UV spectrometer at 203 nm with detection limit ~5 ng. For comparison of different phospholipid extraction method using Folch (FE) and Mojonier (ME) and tertiary amine (N, N-dimethylcyclohexylamine) method. The tertiary amine extracted up to 99% of the phospholipids directly from milk, while only 13.15% ± 0.80% and 8.66% ± 0.30% of the phospholipids were extracted with FE and ME, respectively. These results demonstrate the applicability of SHS for the extraction of phospholipids from dairy products.

Conclusions

Developed method of HPLC-UV system offers advantages of high speed and simplicity for the separation and detection of a variety of phospholipids and its classes in routine quality analysis. The outcomes of this study help to gain insights into the extraction mechanism by which tertiary amine, and develop extraction strategies for dairy products.

Keywords: Milk phospholipids, HPLC-UV, quantification

Climate Change Impact on Flooding

M.S.Waghmare

JSPM's Rajarshi Shahu College of Engineering, Pune

Abstract — climate change has significant impact on water availability in larger river basin. Climate changes have a high impact on river discharges. There are various different methods we can use to predict discharge changes in the future. Climate change has the potential to change the hydrological cycle, leading to more intense precipitation with associated changes in the intensity, frequency and severity of floods. Climate variability and change beyond a few years to a few decades ahead have significant social, economic, and environmental implications. It is believed that some aspects of this decadal variability could be predictable for a decade or longer in advance. The present study evaluates the possible impact of climate

change on flooding. flood warning to the community involves significant uncertainty. The main objective of this present study is to assess the potential impact of climate change on flooding.

Keywords: climate change, precipitation, flood, GCM, RCM

Introduction

Climate change is a variation or change in the climate (temperature, wind, precipitation pattern) in a specific location, region, or of the entire planet. This change in weather pattern persists for a long period of time ranging from decades to millions of years. Climate change may be caused by a variety of different factors including various natural processes. In the region, climate change could mean warmer winter, hotter summer, and more frequent weather events. Scientist predicts that there will be long term damaging impact to our built, natural and human system. The warmer air can hold more water; climate change can give the potential for strong rainfall events. This means that the flooding risk however will vary widely from location to location depending on local climatic changes that at present are difficult to predict. Floods can cause either by an excess of rainfall leading to greater surface runoff or by storm surges raising the sea level. Human activity can increase the risk e.g. by paving over areas which were previously covered by vegetation, reducing the capacity of the land to absorb rainfall and causing it to run off more quickly

Extreme weather events are usually associated with unusual atmospheric circulation patterns. In normal condition circulation pattern vary over time and bring with them different type of weather. Excess rainfall is caused when the atmosphere becomes stuck on one pattern of circulation, giving wet weather for a reservoir can become saturated which can lead to flooding as additional rain runoff the land surface. There will be the potential for the atmosphere to hold more water but climate change may also result in changes to large scale atmospheric circulation pattern like the jet stream which are harder for climatic simulation to predict. The risk of coastal flooding is influenced by the frequency and intensity of storms and by the local sea level. Although in most areas it is not possible to predict the effect of climate change on storms with certainty.

Significance of the Study

Considering all natural hazard, floods are the most hazardous, frequents and wide spread throughout the world. This makes flooding an important subject to study particularly. Flooding is a hydrological phenomenon characterized by both precipitation and soil water contribution. Precipitation and temperature are the key climatic response factors influencing flood events. Flood management using storage structures have become the best alternative to society. With technological development flood modeling is now seen as an integral part of flood management. The Intergovernmental Panel on Climate Change (IPCC), in its assessment report focused about climate change impact. Poor urban planning in cities are experiencing the negative impact of changing weather pattern associated with climate change and climate variability with future projection.

The future trend in the climate system leading to extreme hydrological events gives no cause for comfort. As a result of the greenhouse effect this is being heightened by anthropogenic factors. It is expected that in future the metrological condition that favor extreme hydrological event. Ground base study, calibration, and verification result show that climate change resulting in heavy precipitation play a vital role in flood generation in the catchment An easy way to comply with the conference paper formatting requirements is

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Literature View

Fortunately, lot of literature is available on this subject via net in the form of books, research papers etc. However, a brief review of selected sixteen papers is listed below in a table form. "Appropriate hydrological modeling of climate change impacts on river flooding" by M.J.Booij is expressed that the dominant process and associated key variable are identified and statistical

analyses with respect to key variable are performed which result in appropriate spatial as well as temporal scale for each key variable. Finally he concluded The model and generated precipitation series for current and changed climate condition were used to simulate discharge series. The appropriate model is complex enough in this study although the differences with the less complex model are small.

“Impact of climate change on flood frequency using different climate models and downscaling approach” by S.Camic is focused that A method has been developed in the present study for the determination of the sediment yield from a catchment using a GIS. The method involves spatial disaggregation yield from a catchment into cells having uniform soil erosion characteristics. Finally he concluded that The eroded sediment was routed to the catchment outlet using the concept of sediments delivery ratios defined by equation. Reasonable results were obtained when the proposed method was used for the determining of sediment yield for several storm events in one catchment in India . The method depends on calibration against a record of axis.

“Effect of climate change on seasonal monsoon in Asia and impact on the variability of monsoon rainfall in southeast Asia.” by Yen Yi Loo, In this paper he expressed that this study investigate the impact of climate change on the seasonality of monsoon Asia and its effect on the variability of monsoon rainfall in southeast Asia The comparison of decadal variation of precipitation and temperature anomalies before the 1970 found general increase which were mostly varying. It conclude that This study has given some insights on the connections between global warming and monsoon rainfall it is evident that the distribution of monsoon rainfall is greatly influenced by a number of weather system.

“Impact of climate change on hydrological regime and water resources management of the Koshi river basin, Nepal” by Laxmi Prasad Devkota (Nepal). In this paper he focus that Assessment is made of the hydrological regime of the basin under climate change. Design flood estimation method was proposed to estimate the peak as well as flood flows for different return period. He conclude that this study assessed the expected climate change impact on river hydrology of the Koshi River and its implication on the proposed koshi high dam project.

“Climate change and its impact on river discharge in two climate regions in China” by H.Xu, Y.Luo (china). This study focus that the uncertainty constrained by GCMs was critical and should always be considered in analysis of climate change impact and adaptation. He conclude that It shows the difference between annual and seasonal river discharges in different climate region, show the difference between changes in extreme flow in median river discharge.

“Adaptive and risk-based approaches to climate change and the management of uncertainty and institutional risk: the case of future flooding in England” by Christian Kuklicke (Germany). In this paper he focus that on how scientific uncertainties about future peak flood flows and sea level rises are accounted for in long term strategic planning. He conclude that It ie explored that the tension between risk based and adaptive management approaches to policymaking in the face of uncertainty. Finally it shows that greater scientific certainty about climate change does not necessarily lead to more certain or more effective policy outcomes.

“An evaluation of the effects of climate change on flood frequency in the Luvuvhu river catchment, Limpopo Province, South Africa” by P M Kandu (South Africa). In this paper he expressed that The distribution model used in the study included the generalized extreme value distribution, the gumbel extreme value type I distribution , the log normal distribution and log pearson type III which could be used to derive the probability of occurrence of flood events. He conclude that The result show that an increase in the peak discharge is to be expected The model shows the highest discharge which could be taken as the estimated limiting value for design purpose.

“Climate change impact assessment of a river basin using CMIP5 climate models and the VIC hydrological model” by Narendra Hengade, T. I. Eldho & Subimal Ghosh The paper is focused on Climate change has significant impacts on water availability in larger river basins. The present study evaluates the possible impacts of projected future daily rainfall (2011–2099) on the hydrology of a major river basin in peninsular India, the Godavari River Basin, (GRB), under RCP4.5 and RCP8.5 scenarios. The study highlights a criteria-based approach for selecting the CMIP5 GCMs, The results indicate an increase in future rainfall without significant change in the spatial pattern of hydrological variables in the GRB. The climate-change-induced projected hydrological changes provide a crucial input to define water resource policies in the GRB. This methodology can be adopted for the climate change impacts assessment of larger river basins worldwide.

“Tools for estimating the effect of climate change on flood flow” in Ministry for the Environment, New Zealand, expressed that The ministry for environment works closely to understand the potential impacts of climate change on the natural resources managed by local authorities. This manual focus on the effect of flooding from fresh water system such as rural and urban rivers.

Challenges identified

Data acquisition from government agencies is a big problem when it comes to dealing with critical issue like floods. Data acquired for this research work is solely from the private agencies as some are not ready to give out such data. Scenarios generation using land use characteristics is about 95% accurate with the remaining 5% being accounted by other atmospheric parameters. Scenarios can be generated by using general circulation model (GCM) but do not give fine details data for research hence the use of regional circulation model (RCM). Research use satellite based data but this does not give round based real time data as some of these data lumped.

Problem Definition

Human lives and properties worth several lost each year due to floods. Government employ the services of agencies such as fire services, the military, private agencies etc. to save lives and properties. To identify incidents of floods and appropriate mitigation measures, the data are paramount importance. As a result it is difficult to obtain information on previous floods therefore making flood investigation a useful research to work. When flooding occurs the economic losses in terms of time and resources in saving lives and properties is huge. The question one will ask is “do people know the causes of flooding, its impacts, and how they are mitigated? Most people know but continue to live in flood prone area.

Identified preventive measures have not helped curtail the problem of flood. Appropriate models become the best option to assess the potential changes in the climate in order to predict future flood likely to occur. Future climate scenarios generation coupled with suitable model is an appropriate tool for flood management with suitable model floods likely to occur as a result of climate change in the future i.e. (next 20 years, 40 years, 60 years, and 100 years) can be predicted for likely impacts.

Research Methodology

The planned research methodology is arrived at after through literature search for similar work. “It is necessary for the researcher to design his own methodology for his problem”. Therefore, only guidelines are taken from the literature to design the research methodology as follows

The overall research process consists of a number of closely related activities, which will be developed continuously rather than following a strictly preplanned sequence. Further research method at each step will be decided along with logical justification. For each method will be decided in consultation with experts in the area including research guide.

The research work involved assembling material which include literature review of floods and their impact and appropriate modeling method used. The information for the study include

Data type identification and sources, Land use characteristics and atmospheric parameters, basin/sub basin area determination, field topography survey of the study area, input of soil and land use data (EDM). The institution required for information is meteorological agency, hydrological service department, soil research institute, Geological services department, Town and country planning department.

Regional circulation models do not replace General circulation models but they are powerful tools used together with the GCMs in order to add fine scale details to their broad scale projections. Scenarios are derived from projections of climate change undertaken by the Global Climate Model (GCM) projection are usually adequate to a few hundreds of kilometers hence not able to give details needed for impact assessment at regional or city levels. Historically GCM have been the primary source of information for constructing climate scenarios and will always provide the basis for comprehensive assessment of climate change at all levels from local to global.

To assess the impact of climate change on flooding the first step is to use a simple screening test to assess whether climate change is likely to significantly affect flooding in your region. If so, detail analysis should be carried out.

1. Select climate change scenarios, e.g. Temperature rise
2. Select a representative sample of past storms /rainfall events
3. Determine the impact of projected temperature rise on the rainfall of these storms.
4. Translate projected rainfall into river flow.
5. Assess any other relevant changes e.g. tide, storm surge
6. Translate projected river flow into projected flooding.

Scope and Applications

In generating climate scenarios, a percentage should obtain to account for other climate suggestion factors such as ocean or sea parameters, forest zones around the study area and wind. Engineers should work on good drainage design and maintains as storm runoffs generated from scenarios precipitation may exceed the obtained values by some minimal amount. The study will bring research considered destruction to lives and properties by floods. Flooding the city can be in other form such as volcanic eruption, heavy sea rise and ice fall resulting from future changes in climate. This is interesting research field which experts need to take into consideration in order to avoid any form of disaster. Prediction on lump sum basis is appropriate for large basin area modeling for climate change impact assessment.

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Detection of flood tolerant genotypes in soybean on the basis of uav- based imagery machine learning.

Warik T.D., Pawar.G.S., Mehtre S.P.

College of Agriculture, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani-431402 (Maharashtra), India.

Purpose

Flooding is one of the major abiotic constraints on agricultural production. A plant requires water, but excess of water can negatively impact on their growth and functioning. Flooding restrict oxygen diffusion into the soil and causes hypoxia and anoxia conditions, leads to major yield losses. So developments of flood tolerant varieties are important. We developed flood stress at vegetative and reproductive stages and maintained it for fifteen days, uniform ten centimeter water layer was maintained, and observation were taken place before and after each treatment. Morpho-physiological traits such lenticels (provide oxygen to aerenchyma cells), aerenchyma cells and adventitious roots were associated with water tolerance, so root anatomical traits were studied for determination of tolerant genotypes. We studied root anatomy to determine number of aerenchyma (gas spaces important for oxygen transport) present in genotypes by taking TS of roots and studied under microscope. Root Phloroglucinol dye was used for TS staining. Also studied physiological responses of soybean plant to flood stress in field. For tolerance detection different digital technologies were used such as spectroradiometer, soil moisture sensor, pH meter, Digital cameras, different software's used

for image analysis included Image J tool and MATLAB. Excel software were used for analysis of NDVI and GNDVI.

Root observations included root architecture, canopy, dry weight, fresh weight, root length, root average diameter, number of seminal roots, angle of roots etc., were taken place. 3D images of roots were taken place by digital camera and analyzed with image J tool software. Spectroradiometer which is nondestructive method were used to determine chlorophyll 'a' and chlorophyll 'b' content of plants, leaf area index, NDVI and GNDVI. By using spectroradiometer we determined amount of light absorbed by plants and amount of spectral reflectance. Non treated plants shown reading between the range of 0.6 to 1 and flooded plants shown variable readings less than 0.6. SPAD meter used to determine chlorophyll content. Plants which grown under non stressed conditions shown good chlorophyll content and in stressed conditions shown decreased in chlorophyll content.

Visual observation of number of yellow leaves after each treatment were taken place and according to that rating of zero to ten given to different genotypes. Seed hardening index were determined by image analysis of pods. These technologies are important to screen large number of genotypes within short period and accuracy of observations are more than manual observation. On the basis of observations seven flood tolerant varieties were detected.

Keywords:aerenchyma, normalized difference vegetation index (NDVI), green normalized difference vegetation index (GNDVI), hypoxia, anoxia, seed hardening index.

Objectives:

To study the soybean responses for flood stress on the basis of image analysis

To evaluate the suitable genotype for flood stress

Methodology:

The experiment was conducted at Soybean research station at VNMKV, Parbhani. (M.S.) in the year of 2021 -22. Seeds of 27 soybean varieties are sown in kharif season at field condition In that 25 varieties and 2 check varieties was included with 2 replications, during sowing Randomized Block Design is used as statistical design. Line sowing method is used during sowing with spacing of 45*5 cm. Two treatments are given with creating two plots included one was waterlogged plot and another kept as non stressed plot.

Foliar damage score also given from 1 to 9 (according to tolerance of genotype)

WATERLOGGED TREATMENT

Waterlogged conditions created after 40 days of sowing when flowering is seen in some genotypes.

(i.e. R1 and R2 stages). Water logged conditions maintained for 15 days with 12-15 cm layer of water above ground surface. Waterlogged conditions were created by making bunds around stressed plot. Two treatment of flooding were given and observations were taken after drainage of water.

Result:

Leaf area : After flooding treatment we have seen that leaf area of stressed condition plot was less than non stressed plants. Leaf area decreased more after second treatment. Under waterlogged conditions plants given less leaves than control.

Chlorophyll content (SPAD):

Waterlogged conditions promote degradation of chlorophyll therefore accelerate leaf senescence. JS-20-116 genotype shown more chlorophyll content under stressed condition. Photosynthetic pigments were significantly lowered than control conditions and as number of stress increases.

Number of seminal roots:

Under waterlogged conditions number of seminal roots are seen more than control, flood tolerant varieties shown more number of seminal roots. JS 20-116, Hardee, KDS 726 shown more number of seminal roots.

Root Length:

Present investigation revealed that, during fifteen days of waterlogged conditions shown less root length than control conditions. The root length of soybean under flood stress significantly decreased.

Root anatomy:

It is revealed that soybean roots under waterlogged condition shows aerenchyma formation and these helps in providing oxygen supply to plants under stressed condition. Genotype Haredee and KDS-726 shown more aerenchyma formation. The size and number of aerenchyma seen very less.

Digital Technologies: 1. NDVI: Plants under stressed conditions shown less NDVI than control ones. Control plots shown reading in between range of 0.6 to 1 and waterlogged plot shown variable readings less than 0.6

Conclusion:

Flooding treatment hampered early root development in soybean although different root inhibition is seen in different lines. We analyzed tolerance according to root morphology and anatomy, We hypothesize that flood-susceptible lines fails to develop fine roots.

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Novel technique for preparation of ber candy**Mukesh Kumar***CCS Haryana Agricultural University, College of Agriculture, Bawal (Rewari), Haryana***Purpose**

The ber fruits are mostly consumed fresh but due to increased production of ber during the season, there is glut in the market and the farmer gets low price for his produce. Moreover, the post-harvest losses in our country are about 20 to 30 per cent because of poor post-harvest management practices and lack of proper storage and cold chain transportation facility. The increased production of ber fruit needs to be supplemented by the proper utilization that would be achieved through processing and value addition. Processed products have food palatability, acceptability and more shelf life. The processing technique should not lead to appreciable nutrient losses and those lost need to be fortified. Several fruits are processed in India in the form of different products. Most common processed products are preserve, dehydrated fruit, canned fruit, juice, pulp, squash, wine and fruit candy. Among these products, some varieties of ber can be converted into ber pulp, ready-to-serve and nectar beverages for more potential and better returns. Processed products can be utilized round the year. These helps to ease out fluctuation in the market price and farmers may get better returns and consumers get value added nutritive products (Kumar *et al.*, 2015). These products of ber have good acceptability and fetches good price in the market. Consumption of one ber fruit in a day would meet the diet requirements of vitamin C and vitamin B complex of an adult as recommended by WHO (Kumar *et al.*, 2016).

Methodology

The experiment on preparation of ber candy was conducted at CCS Haryana Agricultural University, College of Agriculture, Bawal (Rewari). The fully matured yellowish fruits of cv Umran with brown tings on the skin were harvested from the experimental orchard RRS Bawal. Sorted and washed fruits were blanched and used with stone and without stone for preparation

of ber candy. The candy of ber cultivar Umran was prepared after destoning of fruits and compared with candy of stoned fruits as well as from blanched and non-blanched fruits. The fruits were heated in water for blanching. After that fruits were destoned. Blanched, non-blanched, with stone and destoned fruits were soaked in syrup of 40°B TSS and it was increased to 10°B at alternate day up to 70°B TSS. Sugar syrup of 40°Brix was prepared by dissolving 665 g of cane sugar in one litre of water. Citric acid at the rate of 0.2 per cent was added. Sugar dissolved by boiling in water and the scum was removed. The syrup was filtered through a muslin cloth and its concentration was checked by ERMA made digital refractometer.

Without stone and with stone, fruits were kept in a separate container and sugar syrup was poured in fruits. These fruits were covered with lid and little weight was applied on lid so that fruits remain dipped in the syrup. Next day the syrup was drained and poured again after increasing its strength to 50°Brix by adding about 300 g of sugar. This step was repeated on 4th and 6th day and so on. Thus, the fruits were allowed to remain in the syrup (at 50° B) for 5-6 days. Then syrup concentration was increased at 4-5 days interval. Finally, the sugar concentration was brought to 66-70°Brix and maintained for 15 days. After saturation the fruits were drained and dehydrated at 50±5 °C in tray drier oven for 18 to 24 hours. Before drying, the fruits were washed in tap water to remove the stickiness of the syrup. These candies were packed after achieving moisture content of about 15 per cent. The candy was stored at room temperature for six months and observed to study the qualitative changes at monthly interval.

Results

Ber fruits have been modified to obtain the candy with attractive golden brown colour and better storage life and also act as intermediate moisture food. The candy of non-blanched fruits was turned to brownish colour as compared to candy of blanched fruits. Blanching was done to de-activate the enzymes, which could result in imparting certain undesirable properties to the food during storage. Blanching, however, is not extensively used in commercial preservation of fruits. It causes some changes in composition of fruits, which are not much important.

The candy prepared from the destoned fruits was better and more acceptable in organoleptic rating as compared to candy of ber fruits prepared with stone. The organoleptic rating of the destoned candy was 9 out of 9 hedonic scale, however rating of candy with stone was 7.0. The organoleptic rating of both the candy was decreased during storage but it decreased more in candy with stone. Candy of non-blanched fruits was turned to brownish in colour and its rating was 5 on 9 hedonic scale basis. The nutritive value of the destoned fruits candy was better due to smooth surface, however candy of with stone fruits have pricking impressions on the surface. The without stone candy is better option for children's consumption, it also avoids the losses of adhered pulp with stone as well as the cumbersome and time-consuming process of pricking. It can be served to all age group (kids or persons) without hesitation of getting down/ swallow of stone. However, Dhawan (1980) reported that the good quality ber preserve could be prepared by treating the blanched fruits with 2.5 per cent pectinase enzyme solution for 8 hours and thus cumbersome and time-consuming process of pricking could be avoided.

Different methods for preparation of preserve have been described by various workers. Kannan and Thirumaran (2002) studied the method of syrumping, cold and hot for preparation of ber candy. In hot syrumped, fruits were boiled in steam jacketed kettle with sugar or syrup till fruits were thoroughly impregnated with syrup. In another process, they boiled fruits in 40°B sugar syrup for 4 minutes and desired strength of syrup was obtained by increasing the sugar strength by 10°B on alternate days (Anonymous, 1985). Kadam (1995) prepared ber candy, the blanched fruits were dipped in syrup containing 40 per cent sugar and one per cent citric acid for 24 hours. The sugar content of the syrup was subsequently the fruits were kept in 70 per cent syrup for 7 to 8 days. Then fruits were removed from syrup, rinsed in tap water and dried to 16 to 18 per cent moisture. Whereas, Kalsi and Dhawan (2002) reported the glycerol and sugar were

found better for preparation of intermediate moisture slice of guava than those prepared by soaking in sugar syrup. Rani and Bhatia (1986) also prepared pear candy in sugar and glycerol. Similarly, Siddique *et al.* (1990) substituted 25 per cent sucrose with fructose in syrup and candy with 75⁰B TSS proved the better in overall sensory quality and storage life of waxgourd candy. Gupta *et al.* (1981) prepared ber candy in *gur* having higher total sugars, reducing sugars, acidity, ascorbic acid, protein, calcium, P₂O₅ content and OD value. However, the candies prepared in sugar were much liked and rated to be excellent.

Kannan and Thirumaran (2002) reported that the overall acceptability of cold syruped candy (7.1) was higher than the hot syruped candy (5.6) on a 9-1 scale card. The candy dried in solar cabinet drier resulted in a better-quality product. Gupta *et al.* (1980) prepared ber candy and reported that there was a reduction in moisture, ascorbic acid and yeast counts and increase in reducing sugars, acidity content and organoleptic rating during storage.

Conclusion

Candy prepared without stone was better in terms of quality and organoleptic score. This candy is without pricking impressions on the surface, it also avoids the losses of adhered pulp with stone as well as the cumbersome and time-consuming process of pricking. This candy can be served to all age groups without risk of swallow of stone.

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Constraints in Adoption of Scientific Feeding Practices for mitigating the climate change impact in Dairy Sector of West Champaran District of Bihar**Singh B K¹, Kundu M S², Singh R P¹, Gangwar S K³, Kumar R³, Patra A¹, Kumar G¹ and Malkani P¹**¹*Krishi Vigyan Kendra, Narkatiaganj, West Champaran – 845455, DrRPCAU, Pusa, Samastipur, Bihar, India*²*DrRPCAU, Pusa, Samastipur-848125, Bihar, India*³*ICCIC, Madhopur, DrRPCAU, Pusa, Samastipur***Abstract**

Reduction in milk production is one of the major economic impacts of climatic stress in dairy cattle. Reduction in milk yield is further intensified by decrease in feed consumption by the animals to compensate high environmental temperature. Reduced milk production due to thermal stress is attributable only partly to decrease in feed intake. For preparation of mitigation strategy for dairy sector of West Champaran district, can be achieved by the critical analysis of the constraints perceived by the dairy farmers in adoption of scientific feeding practices for the dairy animals. Present study was conducted in 6 purposely selected villages of KVK, Narkatiaganj in which total 120 dairy owners were randomly selected. The major constraints in adoption of scientific feeding practices for dairy animals were the farmer's preferences to grow cash crops mainly sugarcane instead of fodder crops, poor availability and high cost of ingredients of concentrate mixture and unavailability of high yielding variety seeds of green fodder for cultivation of fodder crops.

Keywords: Constraints, Feeding Practice, Dairy Animals, Climate Change and Sustainable Development

Introduction:

West Champaran district lies in the north-west part of Bihar. Its northern part is surrounded by Nepal state where as the western border is divided by the Gandak river. In most of the district mainly mixed type farming practice is prevailed with sugarcane (in large scale) and cereals along with milch animals mainly for livelihood support. Cross bred cattle and buffaloes are the dominating milch animals of the district. Dairy farms of the studied areas were not well organized and also there was no any milk cooperative established in the district. Balanced feeding is important for normal health and optimum productivity of milch animals so scientific feeding management is important for the soundness in the health and the productivity of dairy animals. For establishment of sustainability in dairy sector of West Champaran district, it is important to analyze the constraints critically which is perceived by the dairy farmers in adoption of scientific feeding practices for milch animals.

Materials & Methods:

Present study was carried out in two sub divisions namely Narkatiaganj and Bagaha of West Champaran district by using the structured interview schedule and organizing participatory rural appraisal in 6 purposely selected villages of KVK, Narkatiaganj in which total 120 dairy owners were randomly selected. Direct observation technique and other primary and secondary sources were also used for data recording.

Results:

The major constraints in adoption of scientific feeding practices for dairy animals were the farmer's preferences to grow cash crops mainly sugarcane instead of fodder crops was the first ranked (90.00 %) also founded most significant by Kumar et al. (2020) In addition to this, poor availability and high cost of ingredients of concentrate mixture was second ranked (87.50 %) constraints, unavailability of high yielding variety seeds of green fodder for cultivation of fodder crops through out the year was found as third ranked (81.67 %) constraints, under-feeding due to limited financial resources ranked fourth (72.50%) and non availability of area

specific and high cost of commercial mineral mixtures was found as fifth ranked (62.33%) similarly other important constraints which were perceived by more than fifty percent of dairy farmers were lack of knowledge of recommended feeding practices for milch animals, lack of technical guidance for growing green fodder, non-availability of compound feed in the area and non-availability of land for fodder production were the major constraints in achieving the sustainability in development of dairy sector through adoption of scientific feeding practices in milch animals.

Conclusion:

As evidenced from the study high cost and poor availability of concentrate mixture is most important constraints in adoption of scientific feeding practices in milch animals which can be mitigated by the application azolla feeding or other non conventional feeds similarly area specific mineral mixtures and high yielding varieties of green fodder can be introduced in the studied area preferably through the On Farm Trials and front Line Demonstration programmes by the KVK, and AH/Dairy development department may provide at subsidized rate. Almost similar findings were also observed by Kumar et al. (2012). Considering the prevailing constraints in the studied areas, appropriate strategy should be formulated by KVK with the assistance of line department for upgrading the knowledge of farmers as well as adoption of scientific feeding practices in dairy animals.

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Creating Wealth From Agricultural Waste**Madhu Sharan**

*Department of Clothing and Textiles, Faculty of Family and Community Sciences,
The Maharaja Sayajirao University of Baroda*

Purpose

The word “sustainability” has been understood, very well defined and has sensitized the population to a great extent. Not only in the industry, it has reached to each household through the awareness and incorporation of sustainable efforts in day today life.

The textile industry constitutes an important sector in India's economy. These are not only the torch bearer of modern industrial development in the country but still contribute 30 percent of export earnings. Besides these industries produce about one-fifth of the total value of industrial output and provide employment to about 64 million people.

The textile industry is in process of making the entire supply chain sustainable. There are a lot of sustainable practices for producing conventional and common fibers and textile material and there are a lot of innovative fibers and production methods and technologies available to make textile products sustainable.

India is one of the major players in the agriculture sector worldwide and it is the primary source of livelihood for ~55% of India's population. Agriculture sector in India holds the record for second-largest agricultural land in the world generating employment for about half of the country's population.

Agricultural-based industries produced the vast amount of residues every year. If these residues are released to the environment without proper disposal procedure that may cause to environmental pollution and harmful effect on human and animal health. Most of the agro-

industrial wastes are untreated and underutilized, therefore in maximum reports it disposed of either by burning, dumping or unplanned land filling. These untreated wastes create different problems with climate change by increasing a number of greenhouse gases.

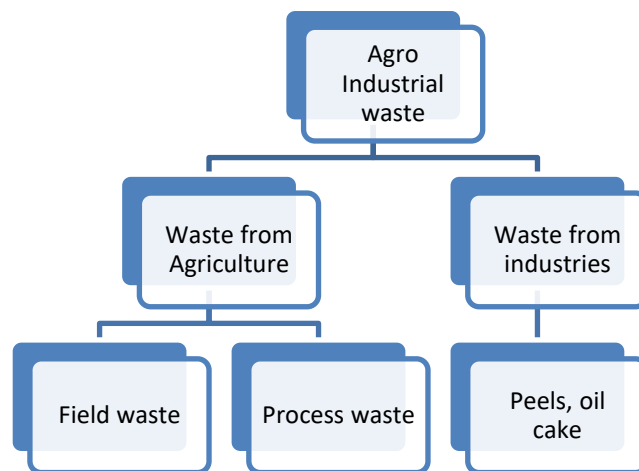


Fig 1. Waste produced from agriculture

Figure 1 shows two different types of agro-industrial wastes, i.e., agriculture waste and industrial waste.

These wastes cause a serious disposal problem e.g. the juice industries produced a huge amount of waste as peels, the coffee industry produced coffee pulp as a waste, and cereal industries produced husks.

Thus, the use of agriculture-waste for the production of textiles fibre has been explored and experimented which resulted in producing innovative fiber from the agriculture waste.

Following are some of the successful experimentation.

Okra fibers

Kigelia Pinnata

Sugarcane bagasse

Pineapple fibers

Lotus fiber

Okra:

Scientific name: *Abelmoschus esculentus*

Type of Fiber : Bast

Morphology: Okra leaves are heart-shaped and three- to five-lobed. The flowers are yellow with a crimson centre. The fruit, or pod, hairy at the base, is a tapering 10-angled capsule 10–25 cm (4–10 inches) in length (except in the dwarf varieties) that contains numerous oval dark-coloured seeds.

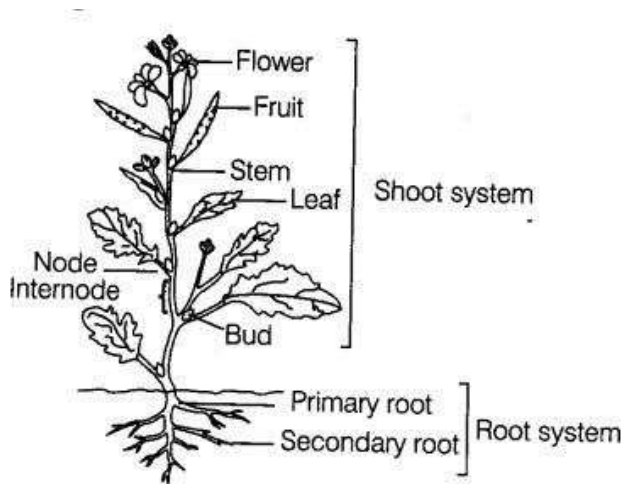


Fig. 5.1 Fig.2. Morphological diagram of Okra Plant

Source: https://itianacademy.com/wp-content/uploads/2021/02/img_602a497c1338d.jpg

Uses: Only the fruit consumed, stalks are agro-waste.

Extraction:

Stagnant water retting

Properties of Fiber:

Okra fiber has a higher moisture regain property.

The fiber is bright, shiny and strong.

The fiber is stiff and harsh.

End use:

Household textiles, technical textiles.

Kigelia pinnata (Sausage tree)

Scientific name: *Kigelia pinnata*

Type of Fiber: Bast

Morphology:

It can reach a height of 20 m, and its features include a grey bark that is smooth at first but peels as it ages; wood that is light brown or yellowish, undifferentiated, and not prone to cracking; and enormous, cylinder-shaped fruits that can measure up to 0.6 m in length and 4 kg in weight. The flowers bloom in the spring and are irregularly shaped like bells, measuring 9 to 13 cm long. They are yellowish on the outside and purple on the inside. The fruits are oblong-shaped, measuring 30 to 50 cm long, and they hang on the stalk for several months. These stalks were used as the raw material for the fibre extraction.

Availability:

Kerala, Tamil Nadu, Karnataka, Gujarat, West Bengal and Maharashtra.

Uses:

Each part of the plant has wide range of medicinal and non medicinal uses. For eg: tree wood for timber, bark for dyes, fruits as inflammatory medicine and so on. Stalks are agro waste.

Extraction:

Water retting

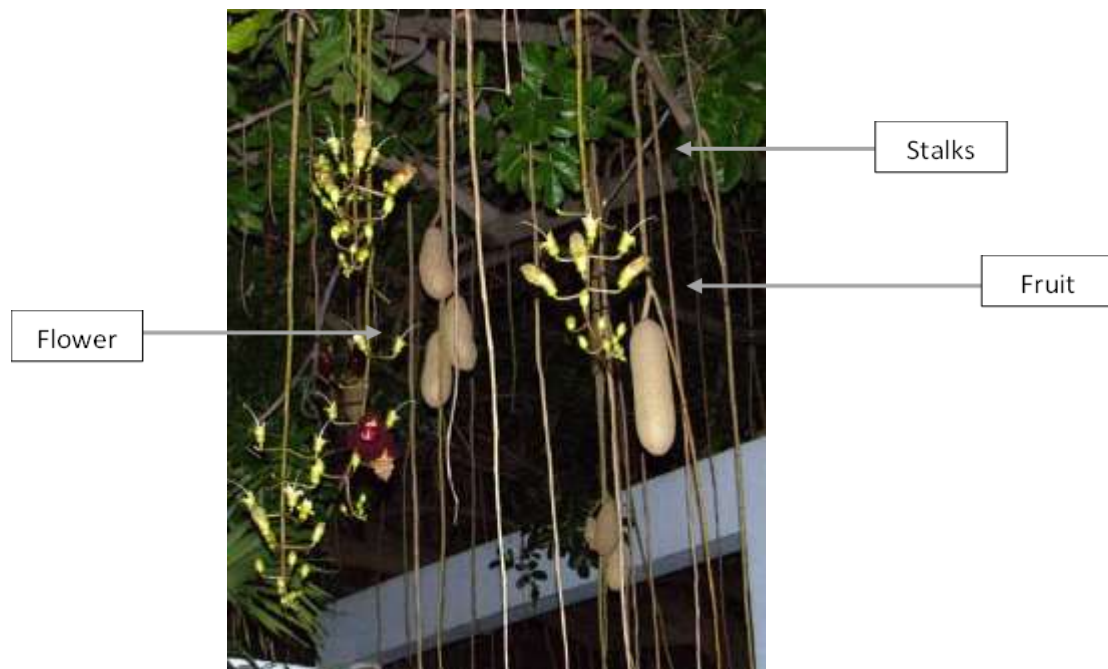


Fig.3. Morphological diagram of Kigelia pinnata ((Sausage tree)

Properties of Fiber:

The fiber has a higher moisture regain property.

The fiber has an inherent antibacterial property.

Fiber has a moderate strength.

Fiber in its raw form is coarser in nature.

End use: Household, medical and technical textiles.

Sugarcane bagasse

Scientific name: saccharumofficinarum

Type of Fiber: Bast

Morphology:

Sugarcane is a tall perennial plant growing erect even up to 5 or 6 metres. The plant is composed of four principal parts, the root system, the stalk, the leaves and the inflorescence.



Fig.4. Morphological diagram of Sugarcane Plant

Source: <https://www.researchgate.net/publication/348377156/figure/fig7/AS:981880795045891@1611110032563/Morphology-of-the-sugarcane-plant.png>

Availability:

Maharashtra, Andhra Pradesh, Tamil Nadu, Karnataka, Gujarat, Madhya Pradesh, Goa, Pondicherry, Kerala and Uttar Pradesh.

Uses:

Juice, which is used for making white sugar, and jaggery (gur) and many by-products like bagasse and molasses (for consumption). Bagasse is an agro-waste.

Extraction:

Boiling with continuous stirring

Properties of the fiber:

It has excellent oil adsorption property.



Fig.5. Applications of Sugarcane Bagasse Fiber

Scientific name: *Neumbo nucifera Gaertn.*

Type of Fiber: Bast Fiber

Morphology: It has broad floating leaves and bright fragrant flowers. The leaves and flowers float and have long stems that contain air spaces. It has many petals overlapping in the symmetrical pattern. The root functions of the Lotus are carried out by rhizomes that fan out horizontally through the mud below the water.

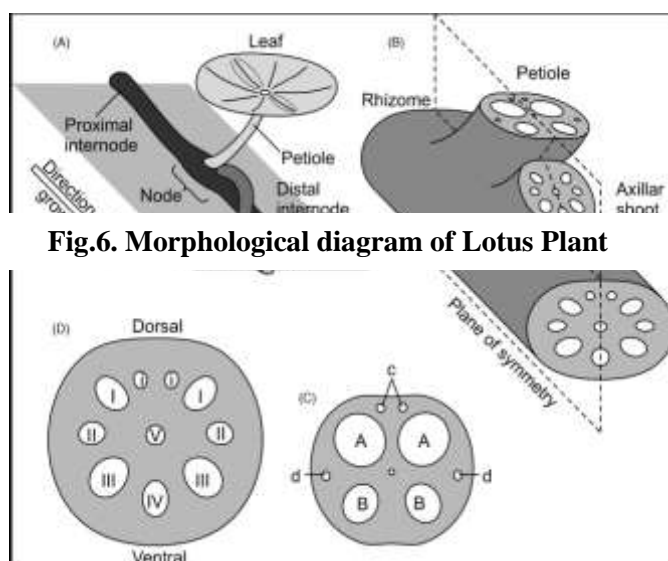


Fig.6. Morphological diagram of Lotus Plant

Source: https://cdn.biologydiscussion.com/wp-content/uploads/2016/12/clip_image018_thumb7-2.jpg

Availability: Himalayan lakes, Assam, Kashmir, Madhya Pradesh, Manipur, West Bengal, Odisha, Rajasthan, Tamil Nadu, Uttar Pradesh, Maharashtra, Karnataka, Mysore and Kerala.

Uses:

The roots are used for making soups. Flowers can be dried and used in cooking. All parts of the lotus plant have medicinal properties such as treatment of inflammation and microbial infections, diabetes, and diarrhoea. Petioles are agro-waste.

Fibre extraction:

Slashing, stretching and twisting,

Properties of Fiber:

Lotus fiber has a higher moisture regain property.

The fiber is extremely fine and soft.

The fiber is inherent antibacterial property.

The fiber has a moderate strength and good elasticity.

Lotus fiber has a good water absorbency property.

End use of fibre:

Apparel, Medical textiles, Sanitary pads, etc.



Fig.7. Applications of Lotus Fiber

Pineapple:

Scientific classification: *Ananas comosus*

Type of fiber: Leaf Fiber

Morphology:

It is considered an herbaceous, tropical, and monocot perennial plant. The size of the plant ranges from approximately 1–2 m tall and wide. Its leaves are spiral in arrangement and on the terminal ends has flowers which then produce edible fruit. The stem at its centre is about 25–50 cm long.

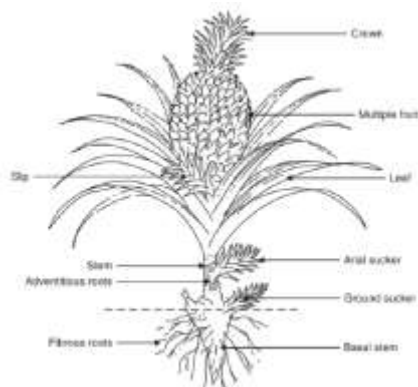


Fig.8. Morphological diagram of Pineapple Plant

Source: https://www.mdpi.com/agronomy/agronomy-11-02221/article_deploy/html/images/agronomy-11-02221-g001.png

Availability:

Assam, West Bengal, Karnataka, Meghalaya, Manipur, Arunachal Pradesh, Kerala and Bihar.
Uses

Pineapple is commonly used in desserts and other types of fruit dishes, or served on its own. Leaves are treated as agro waste.

Extraction:

By decortication, retting, degumming.

Properties of Fiber:

The fiber is light in weight.

The fiber has an elegant appearance similar to linen.

Fabrics made from Pineapple fiber has a fine sheer appearance.

The fiber has a good strength.

Fiber can be blend efficiency with other natural fibers.

End use:

Furnishing cloths, Floor carpet, certain clothes, Bathroom mats, Bedspreads; car seat covers, Tarpaulins, reinforced corrugated roofing sheets, Shoelaces and airbag tying cords were manufactured by converting pineapple leaf fiber yarn by nylon filament through braiding. Textile and apparels.



Fig.9. Applications of Pineapple Fiber

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Development and evaluation of ginger-honey shrikhand - A fermented sweet delicacy
Viren Savaliya, Akshay Ramani*, Kunal Kumar Ahuja, Tanmay Hazra, Vimal Ramani
Kamdhedhenu University Gandhinagar, AMR Dairy Amreli, Gujrat, India

Purpose

Shrikhand is a popular milk based fermented sweet delicacy with sweetish sour taste and is consumed widely in Gujarat and Maharashtra state of India. Technological interventions by previous researchers in shrikhand manufacture and packaging were successful in shelf life enhancement, thus widened the addressable market. Consumer now-a-days explore and demand for natural and healthy foods with new taste and flavour. Variants of shrikhand available in market include plain, mango, dry-fruit, saffron, pineapple etc. the name of which are generally derived from added ingredients. Honey is a syrupy liquid collected by bees and is only sweetener which can be used in natural form. Numerous researchers noted therapeutic characteristics of honey including antibacterial, antioxidant, anti-hypertensive, anti-diabetic and anti-inflammatory capabilities. On the other side, ginger has reportedly been connected to benefits such as reducing nausea sensations, regulating blood pressure, preventing cancer, controlling blood sugar, and having anti-oxidant and anti-microbial qualities. An innovative attempt was made to combined use of honey and ginger in shrikhand making as part of a product range diversification strategy in order to combine benefits derived from honey, ginger, and lactic acid bacteria.

Methods

Effect of milk fat content, sugar: honey ratio and ginger juice concentration was studied on the sensory quality of ginger-honey shrikhand and their levels were optimized using response surface methodology (RSM). Optimized product was evaluated for different physico-chemical, sensory and microbial parameters. Changes in chemical, microbial and sensory quality of ginger honey shrikhand were analyzed during storage of packed samples at $7 \pm 1^\circ\text{C}$. Consumer survey for the newly developed variety of shrikhand was made to evaluate its acceptability among consumers.

Results

Milk fat, sugar: honey replacement ratio and ginger juice levels were optimized in order to develop ginger-honey shrikhand using response surface methodology. Optimized formulation of ginger-honey shrikhand contained 3.16% milk fat, 79.61 sugar: honey replacement ratio and 3.79% ginger juice (on chakka basis) which gave an overall acceptability score (OAS) of 8.07 ± 0.06 on a 9-point hedonic scale. Ginger-honey shrikhand samples when packed in polystyrene cups remained acceptable on 30th day of storage at $7 \pm 1^\circ\text{C}$ with OAS of 7.83 ± 0.06 . Responses from 90 consumers indicated wide acceptability of ginger-honey *shrikhand* among consumers with average overall liking score of 8.25 on 9-point hedonic scale.

Conclusions

Optimized ginger-honey shrikhand samples contained 52.75% total solids, 5.64% fat, 6.12% protein and 39.57% carbohydrates. Consumer survey studies indicated wide acceptability of ginger-honey shrikhand. Present study was an attempt to optimize the formulation of ginger-honey shrikhand with the incorporation of two healthy ingredients honey and ginger. However, total solids level in optimized samples were less than the recommended values by Food Safety Standards Authority of India (FSSR, 2011).

Keywords: shrikhand, optimization, health benefits, traditional products

Effect of Kaempferol on the transgenic *Drosophila* model of Parkinson's disease

Rahul*

Department of Zoology, Faculty of Sciences, University of Allahabad, Prayagraj, Uttar Pradesh- 211002, India.

Purpose

Parkinson's disease (PD) is the second most common age related neurodegenerative disease with unclear pathogenesis. Kaempferol is a polyphenol antioxidant found in many edible plants, fruits and vegetables. The present study indicates the possible usage of kaempferol, as a potent candidate for therapeutic use in Parkinson's disease.

Methods

In the present study kaempferol was added in the diet at final concentration of 10, 20, 30 and 40 μM and the effect was seen on various cognitive and oxidative stress markers. Histopathology of *Drosophila* brain sections was done by performing anti-tyrosine hydroxylase immunostaining.

Results

The results of the study showed that kaempferol increased the life span, delayed the loss of climbing ability as well as the activity in PD flies in a dose dependent manner compared to unexposed PD flies. A dose-dependent reduction in oxidative stress and increase in dopamine content was also observed. Histopathological examination of fly brains using anti-tyrosine hydroxylase immunostaining has revealed a significant dose-dependent increase in the expression of tyrosine hydroxylase in PD flies exposed to kaempferol.

Conclusions

Hence, it is concluded from our study that kaempferol is potent in reducing the PD symptoms being mimicked in transgenic flies and can be used as possible therapeutic agent against neurodegenerative disorders.

Keywords: Kaempferol, Parkinson disease, neurodegenerative disease, oxidative stress

Pollinator's diversity of different agro-ecosystem in Gajapati District of Odisha**Deepayan Padhy, Chitta Ranjan Satapathy and Shimantini Borkataki***Department of Entomology, M S Swaminathan School of Agriculture, Centurion University of Technology and Management, Odisha***Purpose**

Gajapati is a district of state Odisha covering an area of 3850 sq km. More than 60 percent of lands are situated in hilly terrain and high lands. Those are mainly suitable for horticulture. Other cultivable land are coming under medium lands (20 percent) and low lands (15 percent) category. Apart from different horticultural crops, different bee pasture crops like Sunflower, Mustard, Sesamum and Maize is also grown throughout the district. It is absolutely crucial that we can generate knowledge that can be applied to strategies aimed at reversing the decline. In this Gajapati district, Field crops like Paddy, Maize, Ragi, Arhar, Green gram, Black gram; Oil seeds like Mustard, Sesamum and Sunflower; Fruit crops like Mango, Guava, Citrus and Sapota; Vegetables like Sweet potato, Onion, Chilli, Coriander, Garlic; Plantation crops like Coconut and Cashewnut and Fodder crops like Bajra are mostly grown. But till date no data has been recorded related to diversity of pollinators and their contribution towards Agricultural output of these plants in the Gajapati Districts. So it creates an interest towards generating information about assessment of different pollinators present in different cropping ecosystem in this region towards the natural crop improvement program of Gajapati District.

Methods

Extensive data on composition and abundance of pollinators collected through visual observation at 10 days interval during the cropping seasons of 2022-23. The identification of both immature and adult forms is done from a large number of samples by following fixed plot survey in selected experimental sites. The specimens were identified by following the dichotomous keys given in Borror and DeLong's Introduction to the study of insects. The specimens common name, scientific name, family, order, habitat were observed and recorded with their foraging behaviour.

Results

During the course of investigation studies on pollinator diversity revealed that the crop sunflower is visited by an array of pollinators belonging to order Hymenoptera and Lepidoptera. The Hymenopterans were the dominant pollinators. Sunflower crop is visited by three species of honeybees *i.e.* Rock bees, *Apis dorsata*, Indian honeybees, *Apis cerana indica* and Stingless bee *Tetragonula iridipennis*. Along with the bee species some other hymenopterans were also observed foraging on Sunflower *viz.*, *Xylocopa latipes* and *Xylocopa aestuans* were most frequent visitors. Apart from the Hymenopteran pollinators, some lepidopteran adults were also found visiting on sunflower flowers. Those were Tawny Coster (*Acraea terpsicore*), Common Crow (*Euploea core*), Grey pansy (*Junonia atlites*), Blue glassy tiger (*Idiopsis vulgaris*), Plain tiger (*Danaus chrysippus*), Lemon pansy (*Junonia lemonias*), Common/Lemon emigrant (*Catopsilia pomona*), Cucumber moth/Cotton caterpillar (*Diaphania indica*), Oriental hornet (*Vespa orientalis*) and a Wasp species (*Vespa tropica*). Similarly 9 different pollinators were identified from Redgram ecosystem. Those were Rock bee (*Apis dorsata* Fabricius), Leaf cutting bee (*Megachile lanata* Fabricius), Leaf cutting bee (*Megachile disjuncta* Fabricius), Stingless bee (*Tetragonula iridipennis* Smith) and Carpenter bee (*Xylocopa latipes* Drury), Carpenter bee (*Xylocopa aestuans* Linnaeus). Similarly 7 different pollinators were identified from Sesamum ecosystem *i.e.* Indian hive bee (*Apis cerana indica* Fabricius), Rock bee (*Apis dorsata* Fabricius), Leaf cutting bee (*Megachile lanata* Fabricius), Stingless bee (*Tetragonula iridipennis* Smith), Carpenter bee (*Xylocopa latipes* Drury), Carpenter bee (*Xylocopa aestuans* Linnaeus), and Cuckoo Bee (*Thyreus*

ramosus Lepeltier). Similarly 9 and 4 numbers of pollinators were identified from pumpkin and cowpea ecosystem respectively.

Conclusions

The above entitled study concludes that though there were different orders of pollinators identified but the Order Hymenoptera is regarded as the most dominant one. Lepidopterans are pollinators in their adult stage but they are harmful in their larval stage. Even among Hymenopterans, the honeybees are most abundant and most effective pollinators and may contribute towards increase in yield of different subjected to climate change and other biotic and abiotic factors.

Keywords: Pollinators diversity, Gajapati-Odisha crop ecosystem.

Multiple Ovulation and Embryo Transfer: A potent biotechnological tool for enhancing dairy productivity

Brijesh Kumar¹, Pradeep Chandra¹, Vandana², Pradeep Dangi¹, Manoj Donadkar¹, Mohan Gawai¹ and M.H. Khan¹

¹*Division of Animal Reproduction,* ²*Livestock Production and Management Section, ICAR-IVRI,*

ICAR-Indian Veterinary Research Institute, Izatnagar, Bareilly, U.P.-243 122 India

Introduction

The animal market plays a diversified role in global socioeconomic development of the society. Hence, it is necessary to research, discover, innovate, and transfer new knowledge, novel practices, and other alternatives from lab to land that can improve animal reproduction and production. According to 20th livestock census the cattle population in India is 192.49 million which is increased by 8% over last census. Government of India is running many programmes for the conservation of the indigenous breeds and some of the programme are; Rashtriya Gokul Mission (RGM); National Programme for Bovine Breeding, National Kamdhenu Breeding Centres and National Mission on Bovine Productivity. Rashtriya Gokul Mission (RGM) was launched in 2014 by the Ministry of Agriculture for development and conservation indigenous bovine breeds to increase milk production and productivity. After artificial insemination, ETT emerged as most widely accepted reproductive biotechnology in animals and commercial embryo transfer in cattle has become a well-established industry throughout the world. Most semen used IN AI and IVF comes from genetically superior bulls produced by embryo transfer technology. Embryo transfer technology (ETT) is emerged as potent tool for improvement of livestock at faster rate. This technique helps in improving both male and female lineage. ETT is used widely for producing elite bulls from proven sire and dam. The first successful embryo transfer was performed by Walter Heape in year 1981 in rabbit. After which the birth of the first cow calf from ET was done by Willett and coworkers in 1951 at Wisconsin. Multiple Ovulation and Embryo Transfer (MOET), is the technology used for faster multiplication of superior quality germplasm. By using this more number elite calves can be produced at shorter interval of time. Embryo transfer is the most effective tool to improve genetics of dairy animals at faster rate. By using embryo transfer technology, a greater number of progenies can be harvested from superior elite donors (Baruselli et al., 2006; Takahashi et al., 1986). Before superstimulation synchronization of estrous cycle is to be done to bring a group of females into estrus at a predetermined fixed time.

Superovulation (SO) is an effective technique for extracting progeny from genetically desirable females. Since the second follicular wave starts around 8-12 days in cattle so maximum of the superovulation treatment protocol are pragmatic between these days (Purwantara *et al.*, 1993) also in the midluteal phase CL is most responsive to prostaglandin treatment that's why the superovulatory treatment using pFSH (STIMUFOL[®]) is started in mid cycle preferably

between day 8-12 of cycle The primary goal of superovulation is to recover a greater number of transferable embryos from elite animal.

History and economics of ETT:

First report of ETT reported in Rabbit by Halter Heape in 1890. First successful birth of Sheep through this technique propagated in 1949, followed by cattle in 1951. Reproduction in animal has great impact on economic growth of a country and ETT is a great technology to improve economic growth of a country. Previously surgical methods are used in which mid-ventral laparotomy was done in donor animal under halothane anesthesia. Later, in 1970s non-surgical method of ET came into existence. Practically ETT can be used to improve the low genetic potential of both *Bos indicus* and *Bos taurus* cattle.

Methods of Embryo collection

Surgical intervention: Earlier practices involve embryo collection after surgical intervention. The first successful cattle embryo transfer studies obtained from the embryos by a surgical procedure. This procedure was successfully used in sheep and goats. The success of the collection depends upon personnel skill, health status of animal etc. Compared to non-surgical one this is invasive technique not widely accepted in large animals. The donor animal, are fasted and been anaesthetized by intravenous injections of halothane/oxygen mixture for the collection procedure. The embryo recovery was done by using laparotomy procedure and incision is given on (flank or midline abdominal) to expose the reproductive tract. Non-surgical procedures result more recovery of embryos but having more complication i.e, adhesions if procedure is repeated many times Peregrino, 2000).

Non-Surgical Recovery: This is non-invasive technique in which non-surgical embryo were recovered by using specially designed catheter (Worrlein catheter). Ultrasonography provides more accurate information about responses than palpation. Before non-surgical recovery ovaries of donor cows were palpated per rectally or USG to access the number of CL present in ovaries to correlate it with number of embryos recovered. Non-surgical procedure is widely used now a days in cattle and horses. Non-surgical recovery procedure is comparatively simple and can be completed in less than an hour without harm to the donor animal and the donor animal can be used repeatedly for further embryo collection. Before start of this procedure epidural anesthesia is given to animal. DPBS is the flushing medium used to flush uterine horns. In cows and horses, non-surgical collection is repeated numbers of times on a donor animal without affecting fertility of animal.

Steps in involve in embryo transfer

Selection of donor cows

Superovulatory treatment of donor's cows

Artificial insemination of donor on superovulatory estrous.

Collection and grading of embryos

Selection and preparation of recipients

Transfer of embryo in recipients

Superovulation

Superovulation is the process of release of three or more than three ova in cows and more than two ova in buffaloes by using follicle stimulating hormone (FSH), human menopausal gonadotropin (hMG), Equine chorionic gonadotropin (eCG) during mid-luteal phase of the estrous cycle. The main objective of superstimulatory treatment is to recover maximum number of fertilized and transferable embryos from the elite donor animal. The superovulatory response in cattle is unpredictable as it depends upon many factors like age, breed, lactational, presence of dominant follicle, season, and stage of estrous cycle, time of initiation of the superovulatory treatment. Earlier people have used single dose of PMSG hormone for superstimulation, but due to some limitations like long half-life and residual effects this hormone is not used frequently for dairy herds. Follicle stimulating hormone (FSH), which has

a short half-life is used frequently for superstimulation, twice-daily injections of FSH were given for a period of 4-5 days. The superovulatory treatment can be given at mid luteal phase (day 8 to 12) of the estrous cycle. *Bos indicus* breeds are more sensitive to gonadotropin treatment and the amount of hormone required for these breeds is less as compared to *Bos taurus* (Barros *et al.*, 2003; Nilchuen *et al.*, 2011). The *Bos indicus* breeds produce more embryo after superstimulatory treatment as their ovaries are having more follicular population as compared to *Bos taurus*.

Quality evaluation of recovered embryos

Excellent: This embryo is spherical in shape, ideally symmetrical and with all cells of even size and color.

Good: Contains very less extruded blastomeres, irregular in shape and contains some vesicles.

Fair: Extruded blastomeres are present, also contains some degenerated cells.

Poor: A greater number of extruded blastomeres, degenerated cells are present, these quality embryos are non-transferable (Mapletoft *et al.*, 2002).

Factors affecting the superovulatory response and embryo production in MOET

There are numerous factors which affect superovulatory response in animals also individual variation in gonadotropin response is the key problem in embryo transfer industry (Nogueira *et al.*, 2002). The gonadotropin responsive follicular population determine the superovulatory response in animals. Other factors are gonadotropin hormone dose, time of start of treatment, age, season, presence or absence of dominant follicle, antral follicle population, nutritional status of animal, the individual response of the animal and rate & accuracy of estrus detection in different breeds.

Use of gonadotropins

It is the important factor to be considered. There are different types of gonadotropins that can be used in farm animals to get better superovulatory response i.e, follicle stimulating hormone (FSH), human menopausal gonadotropin (hMG), equine chorionic gonadotropin (eCG). According to Monniaux *et al.* (1983) when both gonadotropins FSH and PMSG are used FSH yielded better results in cows.

Effect of season on superovulatory response and embryo recovery

In cattle greater superovulatory response and more ovulations followed by high transferable embryos were recorded in winter season as compared to summer season (Agarwal *et al.*, 1993). The winter season is considered to be better than peak summer and rainy season.

Dose of hormone

Superovulatory response depends upon dose of hormone used in different breed as *Bos indicus* breeds are low LH producer and show greater sensitivity to FSH. The FSH and LH combination ratio in gonadotropin hormone is also an important factor as developing follicle requires more amount of FSH and less LH at early phase of development and its dependency shifts to more LH and less FSH when follicle acquire dominance. FSH treatment should be given from 9th or 10th day of the estrous cycle. A total of eight doses are required which are given at morning & evening for 4 days, a luteolytic dose of PGF₂alpha was also given at 48 hours post FSH administration or on 3rd day of FSH protocol.

Dominant follicle

The presence of dominant follicle in either of the ovary at the start of superovulatory treatment decreases superovulatory response Mapletoft *et al.* (2002). The presence of DF during superovulatory treatment may restrict the recruited follicles from maturing and responsible for their reduced response to gonadotropin treatment (Guilbault *et al.*, 1991). The DF can be ablated before initiation of SO treatment to increase superovulatory outcomes in animals (Patel *et al.*, 2013).

Animal age

The age of donor is also found to have its effect on recovery of embryos. The cows between parity 2-5 are more suitable for MOET also it is advised that the donor for superovulation should not exceed 8 years of age. In cows >9 years of age gonadotropin responsive follicles and superovulatory response is very less. As because in older animals lower number of surface follicles are available to respond the gonadotropin treatment as compared to young animals. Ideally it is suggested that the ideal age for superovulation is up to five years.

Lactation

As health status of an animal is to be maintained postpartum, lactation may affect the SO response, as the essential nutrient are loss in milk. Also, if the animal is in negative energy balance it may show ovarian inactivity. Postpartum animals show presence of less follicles of 10 mm size, as decrease in LH frequency and pulsatile release of LH.

Cost of ETT

This is quite expensive technique but if we will compare benefits of this technique over cost this is very economic technique for faster multiplication of superior germplasm. The cost vs. benefit analysis should be done before implementation of this technique MOET technique is not much costly, except few items like media and hormones. However, flushing catheter is reusable in nature after proper sterilization. At present MOET technique in cattle India is thoroughly and fully standardized as most of the lab in country are getting on an average 6-7 embryos per flushing with a conception rate of 40-45%. Keeping the above merits and technical expertise of technique we strongly recommend this technique must be integral part of breeding policy of any organized breeding herd for faster multiplication of superior germplasm. And, superior donor must be identified under field conditions for ETT and farmers should be encouraged with rewards those who give their animals for MOET, as it is needed for faster multiplication of quality germplasm in nearby area to reap the actual benefits of this technology at large scale.

Conclusions

ETT is the second-generation reproductive biotechnology which is potent in maximizing reproductive efficiency in animal herd. According to International Embryo Technology Society (IETS, 2020) report, the number of in vivo transferable embryos produced worldwide through ETT is 361,728. This number can be increased more in future by efficient application of this technique. This technique can increase reproductive efficiency by improving both male and female lineage, as this technique is used worldwide to produce quality bulls which are later used for artificial insemination. In cattle and buffalo industry ETT can be good alternative that can allow to obtain more number of calf in a year from a single elite donor. Some more benefits of ETT are that, the in vivo-produced bovine embryos are robust and sturdy as compared to in vitro produced embryos and can be made specified pathogen-free by several washing procedures, making this an ideal procedure for disease control programs or in the international movement of animal genetics. Embryo transfer can be a very viable method for genetic improvement or manipulation within any situation. Embryo transfer technology is widely applied in laboratory, university, large commercial enterprise, and even the individual operation, so due to this the application of embryo transfers it is advantageous to our world. This technique is widely used in genetic improvement, genetic implementing, and genetic testing; circumvent infertility, disease control strategies as well as for import and export. ETT application in animal breeding plan enhances the quality germplasm in the animal population. However, a wider spread and competent use of the available techniques is required in order to gain the most benefit from their application. Although multiple ovulation and embryo transfer (MOET) could be a further asset to increase access to improved dairy genetics to smallholder farmers around the world, this technology generally has its own impact to increase or pick up the economic growth and doubling the farmers income. For example, if a farmer rears a calf produced through ETT by using elite dam and sire having >12 liters of milk production /day.

The calf in future may also show same trait and if the hybrid vigor occurs then the calf can show milk production higher than their parent.

Future prospects

The government should support researchers on embryo transfer by allocating budget to use the technology properly in our country. Researchers should concentrate on the embryo transfer to apply the technology properly. The embryo transfer techniques and procedures should be including in veterinary education to reduce failure after application. Newer freezing protocols for embryo should be developed to increase conception rate of frozen thawed embryos as for now the conception rate through frozen thawed embryo is very less as compared to their counterparts. Also, future studies can be designed to add some Follicle and CIDR based synchronization protocols for estrous synchronization in recipients. In future, the FSH depot preparation should be designed to reduce frequency of FSH injections.

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Enrichment Of Fibre Content Of Hydroponic Fodder Maize With Bagasse Substrate For Sustainable Livestock Feeding

Rajkumar, K., Gunasekaran, S., Tensingh Gnanaraj, P and Radhakrishnan, L

Tamil Nadu Veterinary and Animal Sciences University,

Madhavaram Milk Colony, Chennai, Tamil Nadu, India – 600 051.

Purpose

Green fodder feeding to livestock warrants optimization of livestock production. Over the past decades, dwindling pasture lands and reduced area for fodder cultivation have resulted in a deficit status of green fodder. Conventional fodder crops are grown in soil which involves a large land area, more manpower and a huge quantity of water (Butler and Oebker, 1962). In such situations, hydroponic fodder production is an alternative technology to increase green fodder production by vertical farming which requires less land, less water and less manpower. Calapas (2001) defined hydroponics as an advanced form of agriculture which enables the option of exclusive supervision over the distribution and delivery of nutrition among the plants. Hydroponic fodder production is probably best suited to extremely cold, semi-arid, arid, and drought-prone regions of the world, suffering from chronic water shortages or in areas where irrigation infrastructure does not exist. It is a viable, farmer-friendly alternative technology for landless farmers for fodder production (Bakshi *et al.*, 2017). This system helps to overcome the challenges of climatic change and also helps in production system management for efficient utilization of natural resources and mitigating malnutrition. The nutrient content of hydroponic maize fodder has a higher value than maize seeds. In the hybrid variety, the dry matter content is about 86.9%, crude protein 8.4% and crude fiber 2.04%. In local variety (inbred line), the dry matter content is 79.8%, crude protein 9.3% and crude fiber 1.22%. In the other side, the hydroponic maize fodder content of nutrients has a higher value, crude protein 11-12% and crude fiber 2.4 - 3.8%. It is to be noted that the fibre content of the hydroponic fodder is low in terms of minimum requirement for ruminant feeding. Fibre is essential to maintain animal health and is required to maintain an appropriate rumen function and physiology (Aghsaghali *et al.*, 2011), therefore it is the need of the hour to increase the fibre content in the hydroponic fodder. With this background an attempt was made to increase the fibre content of the hydroponic fodder maize using bagasse as a substrate with minimal utilization of water for sustainable livestock feeding.

Methodology

A study was carried out at Institute of Animal Nutrition, Kattupakkam, Tamil Nadu Veterinary and Animal Sciences University. A locally fabricated hydroponic unit, with shade net walls, metal sheet as roof and having manual water sprinkling system was utilized for conducting an experiment with hydroponic maize seeds, fabricated at University Innovation and Instrumentation Centre (UIIC), TANUVAS (Rachel *et al.*, 2015). Good quality yellow maize seeds with less than 12% moisture were selected for the hydroponic fodder production. Seeds were washed in tap water to remove chaffs and dirt. The seeds were then soaked in tap water for 20 hours. After germination, seeds were placed onto different trays and kept on the sprout section of hydroponic green fodder machine. The experiment was divided into two experimental groups. In the control group hydroponic maize was cultivated without base material whereas the treatment group bagasse was used as base material. Good quality maize seeds were purchased, soaked for 12 hours and germinated for 24 hours was used for hydroponic fodder cultivation. In the control group, germinated seeds were placed on hydroponic plastic trays whereas in the treatment group 150 grams of bagasse was used for one kilogram of germinated maize seeds. The hydroponic fodder was cultivated for eight days and during the cultivation period, 800 ml of water per tray was used in the control group whereas 600 ml of water per tray was used in the treatment group. The trays were shifted to the next

rack daily. The biomass yield and shoot yield for the control and treatment group was recorded. The samples were analyzed for proximate composition. Accumulated data was analyzed for statistical significance by independent sample 't' test using SPSS software.

Results:

The results pertaining to the experiment have been given in the table. The biomass yield of the hydroponic green fodder (control) group is 2.20 ± 0.08 Kg / Kg of seeds and biomass yield of the hydroponic green fodder with sugarcane bagasse as substrate (Treatment) group is 3.920 ± 0.06 Kg / Kg of seeds. There was a significant increase in the ($P \leq 0.05$) biomass production per kg of the fodder maize used in the treatment group.

The proximate composition of hydroponic green fodder (control) group is moisture - 56.22 %, CP - 10.55 %, EE - 5.12 %, TA - 1.62 %, CF - 4.72 % and NFE - 78.00 % and the proximate composition of hydroponic green fodder with sugarcane bagasse as substrate (Treatment) group is moisture - 68.55 %, CP - 9.40 %, EE - 3.64 %, TA - 2.00 %, CF - 9.94% and NFE - 75.02 %. Kide *et al.* (2015) have observed the nutritional composition of hydroponic maize fodder in the ranges as follows; CP 13.57 -14.56%, CF 6.37 - 10.67%, EE 3.27 - 4.67%, TA 1.75 - 3.84% and NFE 66.72 - 68.47%. The variation may be due to differences in variety, geographical location, storage duration, irrigation and days to harvest (Jemimah *et al.*, 2018). In the current study, the proximate composition of hydroponic fodder in the treatment group is significantly ($P \leq 0.05$) higher for crude fibre and total ash. A significant increase in crude fibre content in the treatment group was observed, it is an important parameter in ruminant nutrition as it can meet the fibre requirement of ruminants in a better manner. The treatment group performed well in comparison to the control group pertaining to water utilization, as the treatment group utilized 200 ml of less water per day per tray in comparison to the control group.

Conclusion

This experiment clearly demonstrated that hydroponic maize fodder can be enriched with fibre using the low-cost sugarcane bagasse as a substrate. Also, bagasse as a substrate retains more water than conventional hydroponic fodder production making it more affordable. Thus, this study suggests that the hydroponic yellow maize fodder can be enriched with fibre using sugarcane bagasse as a substrate with minimal utilization of water for sustainable livestock feeding.

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Keywords: Fibre, Hydroponic green fodder, Sugarcane bagasse, water conservation

Table: Growth, Nutrient content and water utilization of the hydroponic maize fodder using sugarcane bagasse as substrate (Mean \pm S.E)

Parameters	Control	Treatment
	Conventional Hydroponic fodder maize	Hydroponic fodder maize + bagasse (150 gm/tray) as substrate
Biomass yield (Kg/ Kg of seed)	2.20 ^a \pm 0.08	3.92 ^b \pm 0.06
Shoot weight (grams)	73.0 ^a \pm 1.24	173.0 ^b \pm 1.77
Water utilization (ml/ day/tray)	800	600
Proximate Composition		
Moisture (%)	56.22 ^a \pm 1.98	68.55 ^b \pm 13.59
Crude protein (%)	10.55 ^b \pm 0.18	9.40 ^a \pm 1.88
Crude fibre (%)	4.72 ^a \pm 0.20	9.94 ^b \pm 2.08
Ether extract (%)	5.12 ^b \pm 0.09	3.64 ^a \pm 0.73
Total ash (%)	1.62 ^a \pm 0.05	2.00 ^b \pm 0.40
NFE (%) ^{NS}	78.00 \pm 0.44	75.02 \pm 15.24

Mean of six observations

Means bearing different superscript in the same row differ significantly ($P < 0.05$)

NS- Non significant

Introgression of submergence tolerance gene into Pratikshya, a popular rice variety of Odisha

Madhuri Pradhan¹ and Debendranath Bastia²

¹Department of Agriculture and allied sciences, C.V. Raman Global University, Bhubaneswar, India

²Department of Plant Breeding and Genetics, College of Agriculture, Odisha University of Agriculture and Technology, Bhubaneswar, India

Purpose

Rice is the oldest cereal in the world, and it contributes significantly to the overall food grain production of India. Current yield trends are inadequate to meet projected growth in production in 2050 (Ray et al. 2013). Meanwhile, abiotic factors such as drought, flooding, and temperature extremes are affecting rice production (Sarkar et al. 2006). Among them, flash flooding in rainfed lowlands causes a major losses to rice farmers by submerging rice seedlings for more than 10-days and it leads to death by anoxia. Developing submergence-tolerant versions of popular varieties will be important for sustaining rice production. Understanding of the molecular genetic basis of submergence tolerance in rice has advanced significantly during the past 15 years. A quantitative trait locus (QTL) Sub1 on chromosome 9 was mapped in the tolerant indica cultivar FR13A. Numerous rice cultivars have been developed for submergence tolerance using this Sub1 locus. Recent advances in molecular marker technology accelerated the development of submergence-tolerant varieties (Jena et al. 2015; Pradhan et al. 2019). States like Odisha belonging to the eastern region are frequently affected by flooding due to cyclonic storm. Due to this, the rice cultivation is being severely affected by the submergence problem in rice cultivating areas very often. In this study, we have to improve the submergence tolerance of the rice cultivar Pratikshya by incorporating the Sub1 locus by marker-assisted backcross breeding (MABB).

Materials and method

Swarna-Sub1 possessing *Sub1* gene was used as donor parent. Pratikshya is used as recurrent parent. For foreground selection, SSR markers ART5 and SC3 were used to identify *Sub1* gene (Table 1). 45 polymorphic SSR markers were used for background selection. PCR

amplification was performed using genomic DNA at 56-59°C (annealing temperature). The amplified product was electrophoretically casted in 3.5% agarose gel containing 0.5 mg/ml of ethidium bromide in 0.5XTBE buffer and visualized under UV in a Gel-Doc system and photographed. Progenies obtained from the cross were selected for their evaluation of yield and ago-morphological traits along with the recurrent parent. The mean values of agronomic traits viz., Days to 50% flowering, plant height (cm), number of tillers per plant, number of productive tillers per plant, panicle length (cm), number of filled grains per panicle, seed yield per plant (g) and 1000 grain weight (g) were recorded and evaluated.

Table 1 List of primers used for submergence tolerant gene screening

Sl. No.	Primer name	F/R	Predicted gene	Primer sequence (5'-3')
1.	ART5	F	<i>Sub1</i>	CAGGGAAAGAGATGGTGGGA
		R		TTGGCCCTAGGTTGTTTCAG
2.	SC3	F	<i>Sub1</i>	GCTAGTGCAGGGTTGACACA
		R		CTCTGGCCGTTTCATGGTAT

Results

Genomic DNA from Swarna-Sub1 and Pratikshya was amplified using ART5 and SC3 markers and concluded that the submergence tolerant gene *sub1* was present in Swarna-Sub1 and absent in Pratikshya. F₁ seeds were obtained from the cross between Pratikshya and Swarna-Sub1. 15 true F₁ plants were obtained and hybridized with Pratikshya to produce BC₁F₁ seeds. Foreground selection was performed in 131 BC₁F₁ plants and 59 plants were found to carry *sub1* gene. Selected BC₁F₁ plants were backcrossed to Pratikshya to produce BC₂F₁ seeds. Out of 179 BC₂F₁ plants, 39 plants were found to have *sub1* gene. 48 plants from BC₂F₂ generation were selected by submergence screening in the field. Seeds from tolerant plants having similar agronomic characteristics to Pratikshya were raised to obtain the BC₂F₃ population and 24 plants were found to possess the *sub1* gene. After background selection, 10 plants showed a high recurrent parent genome recovery percentage of more than 90 percent. 24 introgressed lines at BC₂F₄ generation along with the donor and recipient parents were evaluated. Using mean values of agronomic traits, the statistical analysis revealed that many lines did not show any significant variation as compared to Pratikshya for most of the characters. The mean of all characters was at par with Pratikshya in most of the lines. Many lines showed seed yield higher than Pratikshya. In most of the lines mean seed yield/plant was at par with the recipient parent Pratikshya. The ten lines having a parental genome recovery percentage of more than 90% were at par with Pratikshya for all the characters. The yield and agronomic traits of the introgressed line in this study are similar to Pratikshya, indicating no yield penalty associated with the presence of *sub1* gene.

Conclusion

The study showed that the introgressed lines tolerant to submergence which can be further evaluated for release of a variety and they can also be used as donor for introgressing in other elite genetic background.

Keywords: Rice, marker assisted backcross breeding, molecular markers, submergence

Evaluation of mean performance of mid-late/late cauliflower genotypes for various horticultural traits

Neha Rana^{1*} and Akhilesh Sharma²

¹Department of Vegetable Science, Punjab Agricultural University, Ludhiana

²Department of Vegetable Science and Floriculture, CSK Himachal Pradesh Agricultural University, Palampur (HP)

Purpose

Cauliflower (*Brassica oleracea* var. *botrytis* L., $2n = 2x = 18$) is one of the most important vegetable crops belonging to the family Brassicaceae with a genome size of 584.60 Mb. It is grown in many countries across the world for its nutritive value as well as for its value-added foods in the processing sector. The name cauliflower is derived from two Latin words ‘*Caulis*’ and ‘*Floris*’ which means stem and flower, respectively, and is the only cole crop in which the intermediate stage of curding lies between the vegetative and reproductive stages. Because of its wonderful taste, flavor, and nutritional value, it is designated as “India's pride”, “queen of winter vegetables” and “aristocrat of vegetables”. Being one of the most popular vegetables in India, cauliflower has a lot of potential for its improvement. However, because cauliflower breeding is still progressing at a slower rate, the yield is not rising significantly. Thus, the present study was undertaken to evaluate the mean performances for morphological, yield, and quality traits in cauliflower that would help in selecting superior genotypes with better horticultural traits, which can further be used in future hybridization programs to either exploit heterosis or isolation of transgressive segregants.

Methods

Thirty-six genotypes including three checks ‘Palam Uphar’, ‘Pusa Snowball K-1’ and ‘Pusa Snowball K-25’ were evaluated in α -RBD design with three replications including 9 blocks per replication and four entries per block during the winter season 2021-22. The seedlings were raised in nursery beds of size $3\text{m} \times 1\text{m} \times 0.15\text{m}$ and were transplanted with inter and intra-row spacing of $45 \times 45\text{cm}$, respectively. The observations were recorded on five competitive plants selected randomly from each entry over the replications for 20 traits *viz.*, days to curd initiation, days to first marketable curd harvest, stalk length (cm), leaf length (cm), leaf width (cm), number of leaves per plant, plant height (cm), plant frame (cm), curd polar diameter (cm), curd equatorial diameter (cm), curd size index (cm^2), curd solidity (g/cm), gross plant weight (g), marketable curd weight (g), net curd weight (g), non-marketable curds (%), harvest duration (days), harvest index (%), total soluble solids ($^{\circ}\text{Brix}$) and ascorbic acid content (mg per 100g fresh weight basis). The mean values of data were analyzed for variability (ANOVA) as suggested by Parsad et al. (2007).

Results

The analysis of variance revealed that the mean sum of squares due to the genotypes were significant for all the 20 characters studied. The mean performance of 36 genotypes for various traits revealed a wide range of variation in the performance with respect to marketable curd weight and its contributing traits indicating a great extent of genetic diversity among genotypes and would provide immense scope for genetic improvement in cauliflower through selection. The evaluation of mean performance revealed that ‘DPCaCMS-1’ was top-ranked with an advantage of 25.69 % for marketable curd weight over best check ‘Palam Uphar’ followed by ‘DPCaf-29’, ‘DPCaf-US’, ‘DPCaf-CMS5’ and ‘DPCaf-W131W’ which was mainly due to significant contribution of curd polar diameter, curd equatorial diameter, leaf length, leaf width, optimum plant frame, curd solidity, curd size index, gross plant weight, and net curd weight.

Conclusion

Based on the mean performance, 'DPCaCMS-1', 'DPCaf-29', 'DPCaf-US', 'DPCaf-CMS5', 'DPCaf-W131W' and 'DPCaf-S122' were top-ranked genotypes for marketable curd weight and significantly outperformed the best check 'Palam Uphar'. These genotypes can be used in future breeding programs

Keywords: Cauliflower, Evaluation, Genotypes, Mean performance, Marketable curd weight.

Response of integrated nutrient management on seed germination, vigor, and yield of *Amaranthus* (*Amaranthus tricolor* L.)

***Saurabh Yadav¹, K. P. Asati² and Swati Barche²**

¹Department of Vegetable Science, Punjab Agricultural University, Ludhiana, Punjab, India

²Department of Horticulture, College of Agriculture, Indore, Madhya Pradesh, India

Purpose

Growth, yield, and quality of Amaranth depend on nutrient availability in soil, which is released to the judicious application of manures and fertilizers. Increased use of inorganic fertilizers in crop production deteriorates soil health, causes a soil health hazard, and creates an imbalance in the environment by polluting nature (Tayade *et al* 2012). Therefore, the present study was conducted to find out the effect of different levels of manures, fertilizer, and biofertilizers application, either alone or in combination on seed germination, vigor, and yield of Amaranthus. Recommended rates of organic manures *viz.*, farmyard manure and vermicompost/biofertilizers *i.e.*, *Azotobacter* and *Phosphate solubilizing bacteria* were integrated with the recommended dose of fertilizer.

Method

The experiment was conducted during *Kharif* season at the Nursery area, Department of Horticulture, College of Agriculture, Indore, Madhya Pradesh, India. The field was divided into 39 plots (2.25 m X 1.05 m each plot) having irrigation channels and paths. The thirteen treatments, T1: Control (No use of Fertilizers and manures), T2: Recommended dose of fertilizers (R.D.F.) (60,40,20), T3: 100% FYM (5 tonnes/ha), T4: 100% Vermicompost (2.5 tonnes/ha), T5: *Azotobacter* (200g/10 kg seed) + *PSB* (200g/10 kg seed), T6: 75% R.D.F. + 25% Vermicompost, T7: 75% R.D.F. + 25% FYM, T8: 75% R.D.F. + 25% Vermicompost + *Azotobacter* + *PSB*, T9: 75% R.D.F. + 25% FYM + *Azotobacter* + *PSB*, T10: 50% R.D.F. + 50% Vermicompost, T11: 50% R.D.F. + 50% FYM, T12: 50% R.D.F. + 50% Vermicompost + *Azotobacter* + *PSB*, T13: 50% R.D.F. + 50% FYM + *Azotobacter* + *PSB* were evaluated in randomized block design with the three replications. Prior to sowing in the plots, seeds were treated with thiram @ 2.5 g/kg and then with *Azotobacter* and *PSB* @ 200g/10 kg seed. FYM @ 5 tonnes ha⁻¹ and vermicompost @ 2.5 tonnes ha⁻¹ were incorporated in the field at the time of field preparation as per treatments. Half dose of nitrogen @ 60 kg ha⁻¹ and a full dose of phosphorus @ 40 kg ha⁻¹ and potassium @ 20 kg ha⁻¹ was also given as per treatment in the plots as basal dose and the remaining quantity of nitrogen was applied as top dressing at each foliage cutting. By maintaining row to row distance of 45 cm, seeds were sown in the plots @ 2 kg ha⁻¹ in the third week of July. Gradually thinning was done at 5 cm height to achieve a final spacing of 15 cm between the plants.

Result

Results revealed that the treatment T₁₂ which consists of half dose of NPK + half dose of vermicompost + *Azotobacter* and *PSB* observed early emergence of seeds (3.60 days) along with higher germination percentages (84.53 percent) as well as vigorous seedlings in terms of vigor index-I (5.75) and vigor index II (5.56). The crop was harvested three times at a height of 20 cm and by the application of treatment T₁₂ plants take minimum time for harvest *i.e.*, 21.65, 30.65, and 41.16 days along with the highest yield *i.e.*, 0.50, 1.15, and 0.85 kg per plot at first second and third harvest respectively.

Conclusion

We can conclude that the integrated use of biofertilizers, organic manures, and chemical fertilizers in combination at the right time significantly affects the growth and yield of amaranthus because the analysis of variance revealed significant differences among the treatments for all the characters that were studied. Combining organic manure with inorganic fertilizers not only increases crop output but also helps to improve the physical state of the soil and serves as a reservoir for nutrients (Castellanos *et al*, 2000).

Keywords: Amaranthus, Germination, Integrated Nutrient Management, Yield.

Effect of Integrated Nutrient Management on Growth, Yield and Quality of Okra

Shyam Kumar

Department of Vegetable Science, Punjab Agricultural University, Ludhiana, Punjab

Purpose

To evaluate the effect of basal application of organic and inorganic fertilizers on vegetative growth, yield, and quality aspects of Okra.

Methods

The experiment was laid out in a random block design with three replication and eleven treatments. The treatment combinations were T₀ (Control), T₁ (FYM@20ton/ha), T₂ (NPK 100%), T₃ (PSB 100%), T₄ (Azotobacter 100%), T₅ (Vermicompost 100%), T₆ (NPK50%+Vermicompost50%) T₇ (NPK50%+FYM50%), T₈ (NPK50%+Azotobacter50%), T₉ (NPK50%+PSB50%), T₁₀ (NPK 75%+Vermicompost25%). The plot size was 1.8 x1.2 meters and the spacing followed was 45x30 cm to keep 16 plants per plot for each treatment. The seeds were sown directly to the field. Light irrigation was given after sowing. The observations were recorded in four randomly taken and tagged plants for each replication on morphological traits viz. plant height (cm), number of leaves per plant, protein content, T.S.S., and Ascorbic Acid. The data on these parameters were subjected to statistical analysis to draw a logical conclusion.

Results

The maximum vegetative growth in terms of plant height at 90 DAS (100.35cm), number of leaves at 90 DAS (27.90), and diameter of the stem (87.44mm) were recorded in the treatment T₂ receiving a combination of (NPK 100%). The minimum values for all the above vegetative parameters were found in T₀ (Control). These results are closely confined to the findings of Patil *et al* (2003) and Bairwaet *al* (2009). The yield parameter like, the number of days taken to first flowering (33.43), number of flowers per plant (17.04), number of fruits per plant (16.50), length of fruit (12.24cm), the weight of fruit (12.11gm), fruit yield per plant (180.40 gm) were recorded with the treatment T₂ receiving (NPK100%). The quality parameter like the highest protein content (16.30%) and total soluble solid (2.24%) is noticed in treatment T₂ (NPK 100%) while in term of ascorbic acid content T₄ (Azotobacter 100%) produced the highest ascorbic acid (23.321mg). and the reducing sugar (2.00%), non-reducing sugar (2.78%), and total sugar (3.11%) were recorded under T₃ (PSB) Phosphate solubilizing Bacteria.

Conclusions

From the above findings, it is concluded that the application of NPK 100% (T₂) at an optimum level is quite effective for the growth, yield, and quality parameters like Protein and T.S.S. content. And Azotobacter 100% (T₄) provide a better quality of okra in term of Vitamin-C and (PSB) Phosphate solubilizing Bacteria 100% (T₃) in term of Reducing sugar, non-reducing sugar, and Total sugar.

Keywords: Integrated Nutrient management, Growth, Okra, Yield

Genetic Variability and G x E Interaction Studies for Agro-Morphological and Physio-Biochemical Traits in Mungbean [*Vigna radiata* (L.)Wilczek]**Anil Kumar^{1*}, N. K. Sharma²**¹*Department of Genetics and Plant Breeding, College of Agriculture, Bikaner, Swami Keshwanand Rajasthan Agricultural University, Bikaner, Rajasthan-334006, India.*²*Additional Director Research (Seeds), Swami Keshwanand Rajasthan Agricultural University, Bikaner, Rajasthan-334006, India.***Purpose**

Mungbean is an ancient pulse crop widely cultivated under different agro-ecological situations in India. It is the potential source of protein, essential minerals and vitamin-B (vitamin-C in sprouting grains). Genotype and its interaction with the prevailing environment is the basic factor determining the final yield. The genotype x environment interaction is particularly important in the expression of quantitative characters, which are controlled by polygenes and are greatly modified by environmental influences. Thus, in order to have unbiased estimates of various genetic components, it is imperative that the experiment must be repeated over different environments. The evaluation of genotype x environment interaction gives an idea of the stability or buffering ability of the population under study. Genotype x environment interaction is of common occurrence and often creates manifold difficulties in interpreting results and thus hampers the progress of breeding programme aiming at the further genetic improvement of crop plants. Hence, the knowledge of magnitude and nature of genotype x environment interaction is very useful to a breeder for proper understanding and assessment of his material. So it is necessary to screen and identify phenotypically stable genotypes which could perform more or less uniformly under different conditions. The current study aimed to identify the high potential stable genotype and appropriate sowing time for mungbean cultivation in hot arid zone of Rajasthan.

Methods: A field experiment was conducted with 35 mungbean genotypes over four environments created by four different dates of sowing in RBD with three replications at SKRAU, Bikaner during summer-2019 and *Kharif*-2019 using the model of Eberhart and Russell (1966).

Result

Stability parameters revealed that genotype IC-39269 exhibited stable performance for number of seeds per pod, biological yield per plant and harvest index across the environments; whereas, IPM 02-3, MH 2-15 and RMG-344 exhibited stable performance for seed yield under favourable environment i.e. *Kharif* season; and genotype IC 103059 for stressed environment i.e. summer season.

Conclusion

IPM 02-3, MH 2-15 and RMG-344 exhibited stable performance for seed yield under favourable environment i.e. *Kharif* season.

Keywords: Mungbean, Genotype x Environment interaction, stability and seed yield.

Impact of moisture stress on yield and yield attributes in Indian mustard (*Brassica juncea* L. Czern & Coss) genotypes**Rhythm^{1*} and Pushp Sharma²**^{1,2}*Department of Botany, Punjab Agricultural University, Ludhiana, 141004***Purpose**

Indian mustard (*Brassica juncea* L. Czern & Coss) is predominantly grown oilseed crop of India and it is exposed to many environmental stresses like cold, heat, salinity and drought that limit its growth and yield. There is increasing concern over the effect of climate change on water resources, thus effective use of water is the present need. With the availability of

germplasm, studies were required to explore the performance of genotypes and assess variation in *Brassica juncea* for drought tolerance. The present investigation was carried out to study the differential response of *Brassica juncea* genotypes under rainfed and irrigated conditions.

Methods

The field experiments were conducted at the research farm of Oilseed section, Department of Plant Breeding and Genetics, Punjab Agricultural University, Ludhiana. The genotypes taken for present study were JC 210-335, CJRD 1261, RB-50, RH 406, PBR 422, ELM 38, CSR 1163, IAN, MCN 09-40, MLM 41-13-2, PBR 357 and RH 1518. The mustard crop was sown in Factorial Randomized Block Design (RBD) under three replications. There were two irrigation modules comprised,

(a) I₀, only pre-sowing irrigation, referred as rainfed (RF) and

(b) I₂, two irrigations, first at 35 and second at 65 days after sowing, referred as irrigated (IR).

Results

Seed yield and yield attributes varied significantly in the genotypes and with irrigation modules. Moisture stress significantly decreased number of siliquae on main shoot (SMS) by 7.1%, total siliquae/ plant by 8.7%, 1000 seed weight by 21.2% and siliqua length by 7.8% over irrigated condition. Average reduction in seed yield was 12.7% and oil content was 1.5% under rainfed condition as compared to irrigated condition. 1000 seed weight ($r=0.675^*$) had significant positive correlation with seed yield under rainfed condition. Due to water deficit, PBR 357 showed least reduction in seed yield (2.5%) and also in oil content (0.2%) over irrigated condition.

Conclusions

Under rainfed condition, seed yield and yield attributes decreased significantly. Due to lower reduction of seed yield which is $\leq 20\%$, RB-50, RH 406, PBR 422, CSR 1163 and PBR 357 were promising Indian mustard genotypes under moisture stress.

Keywords: Moisture stress, Brassica, yield, siliquae, rainfed

Mitigating the moisture stress through conservation tillage in *Brassica carinata*

Mamta Pal^{1*} and Pushp Sharma²

¹Department of Botany, Punjab Agricultural University, Ludhiana

²Department of Plant Breeding and Genetics, Punjab Agricultural University, Ludhiana

Purpose

Zero tillage - is a sustainable conservation agriculture technique promoted by FAO for food security among growing population along with environmental sustainability in the era of climate change. The practice is well adapted in rice-wheat cropping system but research on rice-upland crop is very scarce such as *Brassica* spp. of Oilseed rape.

Methods

Varieties were evaluated in a split-split plot design in the experimental area of BISA, Ludhiana. Irrigation modules (moisture stress, restricted and normal irrigation) were in main plot, tillage (Conventional and zero tillage) sub plot and two varieties of *B. carinata* (PC-5 and PC-6) in sub-sub plots. At flowering stage, physiological parameters viz. LWR, RWC, membrane stability, SPAD, NDVI and hill reaction activity was recorded following standardized protocols along with yield contributing attributes specifically test weight, total siliquae/plant, biological and seed yield.

Results

The physiological traits improved with the zero tillage in all the irrigation regimes. LWR was higher in ZT under moisture (4.7%) and restricted moisture (5.4%) over CT. RWC was higher by 2.5% (moisture stress), 3.8% (restricted moisture) in ZT compared to CT. Membrane stability improved with zero tillage 23.1% (moisture stress), 25.3% (restricted moisture), and

29.2% (normal irrigation). PC-6 had higher SPAD and NDVI values in both the tillage and irrigation regimes. PC-6 recorded by higher test weight, total siliquae/plant, biological and seed yield.

Conclusions

Zero tillage helped in mitigating the moisture stress by maintaining higher LWR and RWC, membrane stability, SPAD and NDVI values. PC-6 maintained higher yields both under moisture and restricted moisture conditions.

Keywords: Climate change, Moisture stress, Zero tillage, sustainability, NDVI

Influence of Osmoprotectants for enhancing productivity in Bt. Cotton under rainfed conditions

K.N.Pawar

Directorate of Research University of Agricultural Sciences, Dharwad, Karnataka, India-580005

Purpose

Cotton (*Gossypium* spp.) popularly known as “the white gold” is an important commercial fiber crop grown under divers agro-climatic conditions around the world. It provides fiber and raw material for textile industry along with cotton seed and plays a vital role in economy of the country. The role of different Osmoprotectants in plant tolerance to drought stress is significant because they regulate multitude of metabolic processes.

Methods

The present study was conducted at Agricultural Research Station, Dharwad farm during the year 2020-21, 2021-22 to investigate the influence of foliar application of different Osmoprotectants on morpho-physiological parameters for enhancing the productivity in Cotton under rainfed condition. The experiment consisted of eight treatments applied which were 2% urea, 2% KNO₃, 1% Thiourea, Salicylic acid @ 50ppm, Glycine Betaine @ 100ppm, Salicylic acid @ 100ppm and PPFM 1%.

Results

Among all the treatments, foliar application of KNO₃ at 80 and 100 DAS recorded significantly highest plant height, monopodia, sympodia, number of bolls per plant, total dry matter production and boll weight per plant under rainfed condition. Also, 2% KNO₃ application recorded highest Photosynthetic rate (29.5 μ mol CO₂ m² S⁻¹), compared to control (26.1 μ mol CO₂ m² S⁻¹) and seed cotton yield (2310 kg/ha) as compared to other treatments and control (1960.1 Kg/ha) and it was on par with Glycine Betaine @ 100 ppm single spray at 50% flowering (2015.7 Kg/ha).

Conclusion

This study confirms that the osmoprotectants play an important role in enhancing the biochemical, biophysical yield and yield attributing parameters of the Bt cotton. It shows that the foliar spray of KNO₃ @ 2% at 80 and 100 DAS gives us the better result when compared to other treatments. So, it is optimize to use KNO₃ 2% at 80 and 100 DAS to enhance productivity in Bt cotton under rainfed condition.

Key words : Bt Cotton Osmoprotectants, Photosynthetic rte, RWC & Chlorophyll content

Promotion of Barnyard Millets (*Echinochloa esculenta* L.) for Mitigation of Climate Change

¹Danai-Tambhale ²Jagtap B. D. and Kamble S. R.

¹Department of Botany, Annasaheb Magar Mahavidyalaya, Hadapsar, Pune-411028, Maharashtra

²Research Centre, Prof. Ramkrishna More College, Akurdi, Pune-411035, Maharashtra
Mhalasakant Jr. College, Akurdi, Pune-411035, Maharashtra

Purpose

The aim of the experiment is to develop an improved variety by leverage its existing climate resilient characteristics and adding to them higher nutritional characteristics. Produced variety will help farmers' better cope with climate shocks and also provide a good new alternative source of food for consumers. To increase agricultural productivity and incomes of farmers.

Methods

The Barnyard millet crop Phule Butri-1 procured and treated with various dilutions in mM solution of 50 to 150mM with Ethyl methane sulfonate was sown to study chemical mutation.

Results

Crop of Barnyard millet of M1 generation after harvesting from research plot some interesting characteristics features were observed. Harvested crop shows multiple tillers with more number of compact panicles along with extended fingers and grains.

Conclusions

The experiment will help to develop an improved variety by leverage its existing climate resilient characteristics and adding to them higher nutritional characteristics. Produced variety will not only will help farmers' better cope with climate shocks but also provide a good new alternative source of food for consumers.

Keywords: Barnyard millet, Chemical Mutation, Climate resilient

Assessment Of Different Methods Of Sowing In Wheat For Higher Germination, Growth And Yield

Jeetendra Kumar^{1*}, Wajid Hasan¹, R.K. Sohane², Muneshwar Prasad¹, Amrendra Kumar³, Anjani Kumar³ and Abhay Kumar¹

¹Krishi Vigyan Kendra, Jehanabad (Bihar)-804432, India, ²Directorate of Extension Education, BAU, Sabour, Bhagalpur-813210, Bihar, India, ³ICAR-ATARI, Zone-IV, Patna-800014, Bihar, India

Purpose

In wheat sowing, farmers generally use broadcasting method that results poor germination and less yield despite of applying high seed rate which is due to non-uniform seed placement in broadcasting method. Wheat sowing by suitable method at proper depth by using improved implement resulted uniform seed placement, better germination and improved yield. Rawat and Varma (2006) evaluated the performance of zero-till ferti seed-drill for Wheat crop, Sah (2017) conducted trial on zero tillage as a profitable conservation technology and Verma (2017) studied zero-tillage technology and traditional techniques for sowing of Wheat. Keeping this in view, a study was conducted at farmers' field in Jehanabad, Bihar on assessment of different methods of sowing in wheat for higher germination, growth and yield towards approaches for climate change mitigation. The present study aims to determine the parameters -soil moisture, seed rate, plant density, no. of tillers/heal, yield data as well as B: C ratio in use of different sowing method for wheat cultivation in South Bihar.

Methodology

An on farm trial was conducted at farmer's field in Jehanabad district of Bihar (India) during Rabi season 2020-21 and 2021-22 for assessment of different methods of sowing in wheat for higher germination, growth and yield. Jehanabad district is situated at 25° to 25° 15' North Latitude, 84° 30' to 85° 15' East Longitude and at an altitude of 54 meter from mean sea level. It is located in the southern part of Bihar that lies in NARP Zone– III B with sub- humid, sub-tropical agro ecological system. The soil of the experimental area is level having a good tilth. Topography of this district's is alluvial plain and the soil is old alluvial which varies from loam to clay. Maximum and minimum temperature of the district is 47°C in summer month (June) and 5°C in winter month (January) whereas maximum and minimum relative humidity is 99 percent and 26.66 percent, respectively. Mean annual rainfall of the district is 1074 mm out of which most of the rain occurs during the months of June to October.

Farmers of the district generally used broadcasting method in wheat sowing that results poor germination and less yield. The field trial was conducted with 8 and 7 replications along with 0.5 acre plot size in two consecutive years having four technological options i.e. TO-1: Broadcasting of wheat seed (Farmers Practice), TO-2: Line sowing of wheat behind plough and TO-3: Wheat sowing by seed cum fertilizer drill at sowing depth 4-5 cm and TO-4: Wheat sowing by zero till seed cum fertilizer drill at sowing depth 4-5 cm. Wheat var. HD-2733 and HD-2967 was grown with recommended agronomical practices. Soil moisture, seed rate, plant density, no. of tillers/heal, yield data as well as B: C ratio for use of different sowing method was recorded and analysis of the study was done.

Results

Results of the study has been mentioned in Table-1 which indicated that during Rabi 2020-21, highest yield of wheat (41.5 q/ha) along with B: C ratio 2.60 was observed in TO-4 (Wheat sowing by zero till seed cum fertilizer drill at sowing depth 4-5 cm) followed by TO-3 plots (Wheat sowing by seed cum fertilizer drill at sowing depth 4-5 cm) with 40.6 q/ha yield, B: C ratio of 2.20 and 38.4 q/ha yield with B: C ratio 1.98 in TO-2 (Line sowing of wheat behind plough) as compared to 36.2 q/ha yield with B:C ratio 1.94 in Farmer's practice plot (TO-1).

Table 1: Effect of sowing methods on growth parameters, yield and economics of wheat crop

Technology option	Soil Moisture (%)		Seed Rate (Kg/ha)		Plant Density per sq. meter		No. of tillers/heal		Yield (q/ha)		B:C ratio	
	I st Yr.	II nd Yr.	I st Yr.	II nd Yr.	I st Yr.	II nd Yr.	I st Yr.	II nd Yr.	I st Yr.	II nd Yr.	I st Yr.	II nd Yr.
TO-1	20.8	21.2	160	160	389	364	4.9	4.6	36.2	30.5	1.94	1.68
TO-2	20.8	21.2	120	120	385	352	5.1	4.8	38.4	32.6	1.98	1.73
TO-3	20.8	21.2	100	100	387	356	5.5	5.2	40.6	34.2	2.20	1.90
TO-4	23.6	23.8	100	100	387	358	5.8	5.4	41.5	36.8	2.60	2.31

During Rabi 2021-22, maximum yield of wheat var. HD-2967 (36.8 q/ha) with B: C ratio 2.31 was recorded in plots of TO-4 followed by TO-3 plots with 34.2 q/ha yield along along with B: C ratio 1.90 and TO-2 plots with 32.6 q/ha yield with B:C ratio 1.73 as compared to 30.5 q/ha yield with B:C ratio 1.68 in Farmer's practice plot (TO-1).

CONCLUSION

The present study reveals that Wheat sowing by zero till seed cum fertilizer drill at sowing depth 4-5 cm was superior method of sowing for better yield. Among different sowing methods, its use recorded highest grain yield of 41.5 q/ha and 36.8 q/ha along with highest B: C ratio of 2.60 and 2.31 in two respective years of experimental trial. Thus, considering the economics and yield, this sowing method is recommended for wheat cultivation.

Keywords: Plant Density, Sowing depth, Wheat, Zero till seed cum fertilizer drill

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Hydroponic/Soilless Technology – A New Horizon for High value Vegetable Production

U. Thapa & S. Karak

Department of Vegetable Science, Faculty of Horticulture, Bidhan Chandra Krishi Viswavidyalaya,

*Department of Agronomy, Faculty of Agriculture, Bidhan Chandra Krishi Viswavidyalaya
P.O. Krishi Viswavidyalaya, Mohanpur, Nadia -741252, West Bengal*

Introduction

The vegetable crop is well established weapon in solving the problems of food security. Vegetable crops emerge as the key horticultural crops both in domestic and export market. Our country is endowed with a wide range of tropical, sub-tropical and temperate vegetable crops. But still there are some vegetables which are lesser known or rare to most of our growers and consumers. Our farmers can earn a lot of profit by growing these rare or unusual vegetables in nearby big cities (peri-urban areas) and towns as they attract very high prices in cosmopolitan markets, star hotels and places of tourists' interest. Recently a number of exotic vegetables including Broccoli, Brussels sprouts, Chinese cabbage, Red cabbage lettuce, celery, parsley have been introduced and there adaptability studies have been undertaken in different parts of the country. High Value Crops (HVCs) are those, which give significantly higher value productivity or net income per unit of resources used for production, compared to other competing activities. Diversification towards high-value crops such as fruits, vegetables, especially in a country like India where demand for high-value food products has been increasing faster than for staple crops, has proven to increase income level of farmers. Urbanization is a key determinant of demand for HVCs because of higher per capita income, change in tastes and preferences and greater participation of women in labour markets. About 32% of India's population lives in urban areas, which is expected to become 45% by 2030, leading to rapid growth in demand for high value food commodities. The consumption pattern in rural areas is also fast changing in similar pattern.

Horticulture crops are mostly suitable alternatives to fulfil the diversity of Indian agriculture as well as the Indian economy. Vegetables, like other food crops have been traditionally cultivated through open field. In the last few decades, however, open field/soil-based agriculture has been facing some major challenges. Most important among them is the drastic decrease in per capita land availability. This has been attributed chiefly to population explosion,

industrialization and rapid urbanization in the past decades. Also, problems like poor natural soil nutrient recycling due to continuous cropping, frequent drought conditions, unpredictability of weather patterns, rise in temperature, declining ground water level, etc are threatening food production under conventional soil-based agriculture. If such situation rapidly increased, then in upcoming days it will become impossible to raised quality of produce by cultivating the crops in open field system. The main aim of this paper was to understand and create awareness about high value vegetables production under hydroponics/soilless culture systems and to analyze the challenges faced by the farmers to adopt these high value vegetables by using soilless technology. Following are the objectives which need to develop to achieve this aim:

To study the awareness among the people regarding the importance and profitable income from high value vegetables and Hydroponics/soilless technology and its benefits.

To identify the suitable high value vegetables cultivation adopting hydroponic/ soilless culture systems.

To standardised the different modules of hydroponic systems.

To find out the ideal growing media and nutrient solution for producing high value vegetables under soilless culture systems.

Why these vegetables are gaining importance???

With the growth of new food chains like McDonald's, Pizza Hut , Dominoz, KFC, Subway etc., the people are developing new taste buds for new food items.

Preparation of these food items needs many exotic vegetables like Red cabbage, Broccoli, Colored bell pepper, Lettuce, Asparagus etc. Some of which are imported from other countries. So, these vegetable has more profitable market in metropolitan cities and small towns. If farmers grow these crops, they will be benefited.

Exotic vegetables are mainly grown for city markets and now a days they are in high demand in – Shopping malls located in big cities. Five Star hotels /International hotels. Multinational fast food chains

Hydroponic/Soilless

The word hydroponics comes from hydro meaning water, and ponos meaning labour. Hydroponics thus, is the growing of crops in any medium containing nutrients, be it solid or even liquid but without soil. The medium can be anything from a mineral nutrient solution or some inert substrate such as gravel, sand, wool or perlite or even rice husks. The technology was first reported in scientific literature in 1600. The earliest published work on soilless culture was the book *Sylva Sylvarum* published in 1627 by Francis Bacon, and after that water culture became a popular research technique. In India, Hydroponics was introduced in year 1946 by an English scientist, W. J Shalto Douglas and he established a laboratory in Kalimpong area, West Bengal. He written a book on Hydroponics, named as Hydroponics the Bengal System

Why Hydroponics/ Soilless?

Soilless culture is having more relevant option in the present days, to cope up with these challenges. Producing vegetable under soilless culture has shown promising results all over the world. Whenever soil conditions are unfavourable soilless culture can be a good option to produce healthy and quality vegetables. Soilless technology is gaining popularities in recent days due to rapid urbanization and industrialization as well as due to impact of climate change. Soilless cultivation is ideal in urban areas where space is too limited for soil-based gardens. Soilless culture system (SCS) represents an innovative tool to improve the quality of produce at harvest, reducing microbial contamination and eliminating soil and chemical residue spoilage.

A very important aspect of establishing soilless culture is the selection of the proper growing media. The main criteria for selection of a particular substrate should be based on:-

Agronomic characteristics of the substrates

Environmental conditions which can be provided (structure, controls and other facilities)

Effect of substrates on crop susceptibility to diseases

Economic situation of the farm business

Basic Forms of Growing Media

Growing media is usually available in four basic forms:

Soil based(Field soil as a major component)

Organic based(Coco peat, Peat, sphagnum moss , saw dust , wood chips, bark ,etc.)

Inorganic based (Natural media- Vermiculite, Sand, Gravel, Rockwool, Perlite, Pumic, zeolite, etc, and Synthetic media- Hydrogel, Foam mates, Oasis , etc)

HydroponicsSoilless

Plants need water, mineral nutrients and oxygen to thrive. There are six hydroponic setups, based on different ways by which these requirements are fulfilled.

Ebb and Flow System: It requires a medium such as perlite to give stability. Water and mineral solutions are periodically pumped into the tray containing plants. Plants absorb the solution and the remaining solution drains back to the reservoir. This method is simple and used in home gardens. Herbs are grown by this method.

Nutrient Film Technique (NFT): No medium is required. Hydroponic plants are kept in wooden channels having a slope. The mineral solution is pumped to the high end of the channel and slope down water is collected and reused. Plants with large roots are grown by this method.

Drip Systems: It is similar to ebb and flow but here water goes through smaller tubes and drain on top of plants. Small plants having less developed root systems are grown using this method.

Wick Systems: This is a medium based system where perlite or rockwool is used. Nylon rope is placed at the base of each root which extends to the reservoir. It takes up minerals and water and releases it in the medium which makes it available for plants. It is an economical method of hydroponic farming because no pumps are required.

Aeroponics: This is a water-based system similar to NFT and doesn't require a medium. The mineral solution is sprayed onto the plants in the form of mist. This is difficult to set up but is beneficial in the large commercial setting.

Deep Water Culture (DWC): In a container, the plant's root is suspended in oxygenated water containing minerals. An air pump is used. This is an easy method and requires low maintenance.

Research Trial conducted in the University

Studies on evaluation for adoption of high value crops under soilless culture

To popularize soilless culture techniques for producing high value in semi-urban and urban areas.

To find out the best growing medium with respect to growth and yield of sweet pepper, broccoli, red cabbage, Chinese cabbage, celery tomato, cherry tomato,etc under soilless culture.

To standardize the ideal nutrient solution concentration influencing growth and yield of sweet pepper , tomato, cherry tomato , lettuce , spinach ,under soilless culture.



**Conclusions:**

Hydroponic farming has numerous advantages. Hydroponic is also considered as the future of farming. Products that are produced by hydroponics are full of nutrients as compared to the products that are produced by conventional farming. There are various types of hydroponic farming, which are adopted according to the plants that are grown. Hydroponics provides a nutrient solution directly to the roots of plants; plants don't have to spend their energy in the search of nutrient and water. Due to this, plants show their best genetic output. Vegetables that is produced in hydroponics high nutritive value and free from various chemical fertilizers and pesticides.



Implications of climate change on pest populations and their mitigation strategies**N.E. Jayewar^{1*}, P. Duraimurugan² and D.R. Kadam³***Vasantrao Naik Maharashtra Krishi Vidyapeeth, Parbhani, MS, 431402**ICAR-Indian Institute of Oilseeds Research, Rajendranagar, Hyderabad-500 030, Telangana***Abstract**

Species life history (evolutionary) adaptations might mislead our ability to discern species reaction to climate change; as a result, species respond to changes in thermal surroundings differently. There are numerous interactions, and it is exceedingly difficult to estimate the future impact of climate change on insect pests, but we may expect an increase in certain major pests, secondary pests, and invasive species. Farmers' best economic plan is to adopt integrated pest management practises to regularly monitor insect and disease prevalence. Keeping pest and crop management records throughout time allows farmers to assess the economics and environmental impact of pest treatment and determine the viability of adopting specific pest management tactics or cultivating specific crops. Some of the potential adaptation strategies could be developing IPM with more emphasis on biological control and changes in cultural practices, pest forecasting using recent techniques such as simulation modeling and alternate production techniques.

Introduction

Climate change is described by the Intergovernmental Panel on Climate Change (IPCC) as "change in climate over time, either due to natural variability or as a result of human activity" (IPCC, 2001). While rising sea levels, increasing cyclonic activity, and other effects of global warming, changes in temperature, atmospheric carbon dioxide concentrations, precipitation, and other factors will have major ramifications for agriculture, particularly damage caused by insect pests. Aside from these fundamental variables, the increased frequency and intensity of extreme weather events such as droughts, windstorms, and floods disturb natural predator-prey relationships, jeopardising agricultural production in general. The IPCC's most recent assessment report forecast an average temperature rise of 1.1°C to 6.4°C by 2100 (IPCC, 2007). The global temperature has risen. Global temperature has been steadily rising since 1900 with an increase of about 1°C since then. World agriculture is facing a serious threat due to global warming and developing countries suffer more than the richer nations. Developing countries are predicted to suffer 10-25% reduction in agricultural productivity by 2080s. Because of climate change, Indian agriculture is doubly vulnerable. More than 60% of India's cultivated land are rainfed and may have serious impact due to climate change, Further, more than 80% of the Indian farmers are still small and marginal and have lesser capacity to cope up with climate change. Though the greatest increase occurred in northwestern America, India's temperature has increased between 0.2°C and 1°C. The mean temperature in India is projected to increase up to 1.7°C in *kharif* (July to October) and up to 3.2°C during *rabi* (November to March) season, while the mean rainfall is expected to increase by 10 per cent by 2070 (Gupta, 2011). The Asia-Pacific region is to face the worst impacts of climate change with an estimated grain loss to the tune of 50% (wheat), 17% (rice) and 6% (maize) (ADB, 2009).

Insects are cold-blooded organisms - the temperature of their bodies is approximately the same as that of the environment. Therefore, temperature is probably the single most important environmental factor influencing insect behavior, distribution, development, survival, and reproduction. Anthropogenic CO₂ is almost twice more important for temperature increase than other long-lived greenhouse gases combined. Although increased CO₂ should not directly deleteriously affect insects, the temperature increases driven by the increase in anthropogenic CO₂ already affect insects in profound ways including their distribution, nutrition, phenology and role as disease vectors. The article discusses the impact of climate change on insect pests

and Impact of climate change on insect pests, pest challenges and management strategies in oilseed crops under changing climate scenario.

I. Implications of climate change on insect pests:

Insect pests and elevated CO₂ on: In general, host plants grown under elevated CO₂ are less nutritious to insect herbivores, which can affect their behavior and performance. Phenotypic host-plant changes typically make leaf material eaten by insects less nutritious. As a consequence, insects have a more difficult time converting the food they eat into biomass. In order to mitigate the effects of less nutritious food, insect herbivores often consume more. Insect herbivore performance is positively correlated with leaf nitrogen concentrations. Zvereva and Kozlov (2010) reported that the leaf nitrogen content decreased for mustard and collard grown under elevated CO₂. Leaf chewing insect herbivore performance is positively correlated with leaf water content. Decrease in leaf water contents was observed under elevated CO₂ for both mustard and collard. Plants can also defend themselves mechanically, either by having tough leaves or by structures such as leaf trichomes. Levels of mechanical defense are negatively correlated with herbivore performance. Elevated CO₂ increased trichome densities on radish. Several studies, mostly considering leaf toughness, leaf thickness, and specific leaf weight, have also observed increases in mechanical defense due to elevated CO₂. Hamilton (2005) reported higher percent leaf damage or consumption due to cabbage white butterfly fed either mustard or collard grown under elevated CO₂. Similar results have been obtained in leaf miners on a variety of woody species. Zvereva and Kozlov (2010) detected a significant negative effect of elevated CO₂ on insect herbivore performance. They observed that overall herbivore communities were lower on plants grown under elevated CO₂ vs. ambient CO₂. This is likely in part due to higher mortality rates due to both parasitoids and other natural enemies. Natural enemies are thought to have better success under elevated CO₂ because their prey are more apparent. Insects typically take longer to develop, making them more apparent in time to natural enemies. Higher consumption rates also cause increased leaf damage and increased frass production, both cues to natural enemies.

Hamilton et al. (2005) measured levels of herbivory in soybean grown in ambient air and air enriched with CO₂ or O₃ using free air gas concentration enrichment (FACE). Under open-air conditions and exposure to the full insect community, elevated CO₂ increased the susceptibility of soybeans to herbivory early in the season, whereas exposure to elevated O₃ seemed to have no effect. In the region of the canopy exposed to high levels of herbivory, the percentage of leaf area removed increased from 5 to more than 11% at elevated CO₂. They found no evidence for compensatory feeding at elevated CO₂ where leaf nitrogen content and C:N ratio were unaltered in plants experiencing increased herbivory. However, levels of leaf sugars were increased by 31% at elevated CO₂ and coincided with a significant increase in the density of the invasive species *Popillia japonica* (Japanese beetle). In two-choice feeding trials, Japanese beetles and Mexican bean beetles (*Epilachna varivestis*) preferred foliage grown at elevated CO₂ to foliage grown at ambient CO₂. Hence, the increased level of sugar in leaves grown at elevated CO₂ may act as a phagostimulant for the Japanese beetle.

Effects of elevated temperature on insect pests: Many of the effects of increased temperature on insect performance have to do with the direct effects of temperature on insects. Because insects are exothermic, they tend to be more active under warmer conditions. A typical effect of elevated temperature is therefore to increase consumption rates and therefore decrease the time to pupation, making them less apparent to natural enemies and in some cases increasing the potential number of generations per season. It has been estimated that with a 2° C temperature increase insects might experience one to five additional life cycles per season (Yamamura & Kiritani 1998). Elevated temperatures increase gypsy moth performance, both decreasing its development time and increasing its survival rate (Williams et al. 2003). However the survival rate of another member of its genus, the nun moth, is very different under

increased temperatures. If gypsy moths react more favorably to future environments than competitors, they may become more prone to outbreak. Elevated temperatures (on the scale of expected global warming) can also have direct effects on plant phenotypes, but not typically to the extent that elevated CO₂ has, and those factors affected (like total nonstructural carbohydrates, starches, and sugars) don't typically affect insect herbivores as much as host-plant characteristics affected by elevated CO₂.

Temperature may change gender ratios of some pest species such as thrips (Lewis 1997) potentially affecting reproduction rates. Insects that spend important parts of their life histories in the soil may be more gradually affected by temperature changes than those that are above ground simply because soil provides an insulating medium that will tend to buffer temperature changes more than the air (Bale et al. 2002). Lower winter mortality of insects due to warmer winter temperatures could be important in increasing insect populations (Harrington et al. 2001). Insect species diversity per area tends to decrease with higher latitude and altitude (Andrew & Hughes 2005), meaning that rising temperatures could result in more insect species attacking more hosts in temperate climates (Bale et al. 2002).

Effect of changes in Rainfall pattern on insect pests: Early and timely planting become more uncertain under climate change. During the 2009 rainy season, delay in onset of monsoons by 45 days resulted in delayed plantings of pigeonpea that are prone to damage by *Helicoverpa armigera* and caused heavy damage (Sharma, 2010). As with temperature, precipitation changes can impact insect pest predators, parasites, and diseases resulting in a complex dynamic. Fungal pathogens of insects are favored by high humidity and their incidence would be increased by climate changes that lengthen periods of high humidity and reduced by those that result in drier conditions. Some insects are sensitive to precipitation and are killed or removed from crops by heavy rains, this consideration is important when choosing management options for onion thrips (Reiners and Petzoldt, 2005).

II. Direct and indirect effects of climate change on insect pests

Expansion of host range: There are indications of shift of insect pests of plantation crops to new crops and new areas. The rhinoceros beetle, *Oryctes rhinoceros* (Linnaeus) is an established pest of coconut palms in India. Quite recently, it has become a problem for oil palm in southern states of India. The incidence of the pest in oil palm plantations closer to natural forest areas has been noticed at many places.

Extension of geographical range of certain pests: The mealy bug, *P. solenopsis* which was observed for the first time on cotton in USA in 1991 noticed on *Solanum muricatum* in Chile during 2002, and extended to tomato in Brazil during 2005. During 2006, *P. solenopsis* appeared for the first time on cotton crop in Punjab and caused severe losses in Ferozepur, Muktsar and Bhatinda districts. Since then, *P. solenopsis* is a serious pest in several states of India and extending its host range widely. Tea mosquito bug, *Helopeltis antonii* Signoret is a serious constraint in cashew (west coast-Kerala, Karnataka, and east coast-Tamil Nadu). Cashew tracts of Andhra Pradesh, West Bengal and Orissa are free from this pest. The hot spot areas of the bug across the cashew tract of the whole country have been demarcated, taking into consideration the optimum temperature during flushing and following stages. The pest may spread to new areas under current scenario of climate change and states like Andhra Pradesh, West Bengal and Orissa may come under this pest attack in the changed situation.

Rapid population growth: Understanding the shifts that occurred in rice crop can provide a broader perspective of the shifting pest trends. Before green revolution, stem borer, gall midge, rice hispa, whorl maggot, cut worm and thrips were considered as major pests of rice. But, today, rice yellow stem borer, *Scirpophaga incertulas* (Walker), brown planthopper, *Nilaparvata lugens* (Stal), whitebacked planthopper, *Sogatella furcifera* (Horvath), leaf folder *Cnaphalocrocis medinalis* (Linnaeus), gall midge, *Orseolia oryzae* (Wood-Mason), green leafhopper, *Nephotettix virescens* (Distant) and gundhi bug *Leptocorisa* spp., have assumed

National significance. Whorl maggot, *Hydrellia* spp., rice hispa, *Dicladispa armigera*, climbing cutworm, *Mythimna separata* Walker, swarming caterpillar, *Spodoptera mauritia* Boisduval, panicle mite, *Steneotarsonemus spinki* and thrips, *Stenchaetothrips biformis* have attained regional significance.

Minor pests becoming major pests: Stem borer incidence was low upto 1970s, moderate till 1975 and severe and widespread from 1980 onwards and still remains as a major rice pest. BPH not considered as a pest till 1970s assumed major pest status from 1990s to till date. Moderate incidence due to WBPH is reported since 2000 and it has assumed serious proportions in the last decade, particularly in irrigated ecologies. Leaf folder which was moderate till eighties, has become a serious pest in the recent decades. Likewise in cotton, American and spotted bollworms attained secondary pest status, and tobacco caterpillar, pink bollworm, mirids and mealy bugs are emerging as major pests. Adoption of Bt cotton has not only changed the cultivation profile, but also the pest scenario. While there is a decline in the pest status of bollworms; the sap feeders, viz. aphids, jassids, mirids and mealy bugs are emerging as serious pests (Vennila, 2008). Recently, mirid bugs, *Ragmus* spp. and *Creontiades biseratense* (Distant) appeared in epidemic form in South India. Also, some of the minor pests like thrips, *Thrips tabaci* Linderman; shoot weevil, *Alcidodes affaber* Aurivillius and stem weevil, *Pempherulus affinis* (Faust) are becoming serious on Bt cotton.

Increased risk of invasion by migrant pests: The mealy bug, *P. solenopsis* which was observed for the first time on cotton in USA were found on *Solanum muricatum* in Chile and tomato in Brazil. During 2006, *P. solenopsis* appeared for the first time on cotton crop in Punjab and caused severe losses in Ferozepur, Muktsar and Bhatinda districts. Since then this pest has spread to several states like Haryana, Rajasthan, Maharashtra and Gujarat and southern states. Besides cotton, *P. solenopsis* has been recorded on several economic crops like okra, tomato, brinjal, chilli, grape, fig, datepalm, apple, avocado, banana, citrus, etc.

Various species of mealy bugs have started appearing in serious proportions on field crops, vegetables, fruits and ornamentals. In fact, mealy bugs have become indicator insects for the current ecosystem alterations due to slow changes in climate during the period from 2002 to 2005. Among these, *Phenacoccus solenopsis* Tinsley on cotton and *Paracoccus marginatus* Williams and Granara de Willink on papaya have become quite serious. The papaya mealy bug, *P. marginatus*, has become quite alarming in Tamil Nadu, challenging the pesticides or other IPM measures.

In the past 10 years (2008-2018), 12 invasive or alien pests invaded Indian geographical boundaries or have been formally reported. More such examples of pest invasion in India include sugarcane woolly aphid, *C. lanigera*; coconut eriophyid mite, *Aceria guerreronis* Keifer; coffee berry borer, *Hypothenemus hampei* (Ferrari); sapota seed borer, *Trymalitis margarias* Meyrick; Spiralling whitefly, *Aleurodicus disperses* Russell; Serpentine leafminer, *Liriomyza trifolii* (Burgess); Papaya mealybug, *Paracoccus marginatus*; South American tomato leaf miner, *Tuta absoluta*; Rugose spiraling whitefly, *Aleurodicus rugioperculatus* and Fall armyworm, *Spodoptera frugiperda* (Lepidoptera: Noctuidae).

Impact on arthropod diversity and extinction of species: Main effects of climate change on arthropod diversity include decreased abundance of predators leading to increased herbivory (Zvereva and Kozlov, 2010). Thus, any decrease in the arthropod diversity will directly affect the terrestrial ecosystems. Extreme events like drought would drastically reduce the diversity and upset the natural balance of the ecosystems and their functioning. The diversified arthropod community that exist in agroecosystems are responsible for natural balance between herbivores and natural enemies. Climate change can bring unpredictable alterations in this intricate relationships upsetting the entire agroecosystem functioning.

Change in the host phenology and resultant changes in the pest cycle: The diamondback moth, *Plutella xylostella* (Linnaeus), has consistently remained the most destructive insect pest of crucifer vegetables worldwide. Currently, this insect has become resistant to almost all classes of insecticides used against it in south-east Asian countries. An outbreak of diamondback moth, *Plutella xylostella* (Linnaeus) on cauliflower was reported in North India during 2006. The infestation increased gradually from first fortnight of August and lead to total loss (100 % yield loss) of the crop. Moreover, the current climatic change may lead to increase in severity of this pest in many regions of the world. For instance, *P. xylostella* may have two additional generations per year in Japan.

III. Impacts of climate change on insect pest management

In addition to effects on insects, influence of climate change on insect pest management methods were reported (Sharma, 2010), which are described below

Effect of climate change on the effectiveness of biopesticides and synthetic insecticides: Natural plant products, entomopathogenic viruses, fungi, bacteria, and entomopathogenic nematodes, and synthetic pesticides are highly sensitive to the environment. Increase in temperatures and UV radiation, and a decrease in relative humidity may render many of these control tactics to be less effective, and such an effect will be more pronounced on natural plant products and the biopesticides (Isman 1997). Rapid dissipation of insecticide residues due to increases in temperature and precipitation will require more frequent application of insecticides. Disappointingly, some pesticides like pyrethroids, spinosad, etc. are less effective at higher temperatures.

Effect of climate change on expression of resistance to insect pests: Climate change may alter the interactions between the insect pests and their host plants (Sharma et al. 2010). Climate change may also change the flowering times in temperate regions, leading to ecological consequences such as introduction of new insect pests, and attaining of a pest status by non-pest insects (Willis et al. 2008). However, many plant species in tropical regions have the capability to withstand the phenological changes as a result of climate change. Climate change may result on breakdown of resistance to certain insect pests. Chemical composition of some plant species changes in direct response to biotic and abiotic stresses as a result, their tissues less suitable for growth and survival of insect pests (Sharma 2002). However, problems with new insect pests will occur if climatic changes favor the introduction of insect susceptible cultivars or crops. The introduction of new crops and cultivars to take advantage of the new environmental conditions is one of the adaptive methods suggested as a possible response to climate change. Increased CO₂ may also cause a slight decrease in nitrogen-based defenses (e.g., alkaloids) and a slight increase in carbon-based defenses (e.g., tannins). Acidification of water bodies by carbonic acid (due to high CO₂) will also affect the floral and faunal diversity (Gore 2006).

Effect of climate change on effectiveness of transgenic crops for pest management: Cotton bollworm, *Heliothis virescens* (F.) destroyed *Bt*-transgenic cottons due to high temperatures in Texas, USA (Kaiser, 1996). Similarly, *H. armigera* and *H. punctigera* (Wallen.) destroyed the *Bt*-transgenic cotton in the second half of the growing season in Australia because of reduced production of *Bt* toxins (Hilder and Boulter 1999). Cry1Ac levels in transgenic plants decrease with the plant age, resulting in greater susceptibility of the crop to insect pests during the later stages of crop growth (Greenplate et al. 2000; Adamczyk et al. 2001; Kranthi et al. 2005). Possible causes for the failure of insect control in transgenic crops may be due to inadequate production of the toxin protein, effect of environment on transgene expression, *Bt*-resistant insect populations, and development of resistance due to inadequate management (Sharma and Ortiz 2000). It is therefore important to understand the effects of climate change on the efficacy of transgenic plants for pest management.

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Effect of climate change on emerging insect pest and their management strategies**Lad A.G***, Jayewar N.E.,Matre Y. B, Khandare R. Y Sonkamble M.M

Department of Agricultural Entomology,

Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra 431 402

ABSTRACT

Climate change, emerging global concerns have serious effects in every aspects of agriculture. Changed patterns in climatic factors like temperature, precipitation, humidity and other meteorological components are affecting the quality and quantity of agricultural commodities production. Along with direct impacts in crop productivity, climate change is threatening global food production via pest related losses of food crops. Each additional degree of temperature rise could cause yield losses from insect pests to increase by a further 10-25%. Climate change has increased pest population and their damage potential by expanding distribution, enhancing survivability and allowing to develop the adaptability of insect pest. Rising temperature, modified precipitation patterns, disturbed gaseous composition of atmosphere etc. are causing the change in population, mobility and behavior of insect pest. This change has been affecting the global agricultural production figure. Largest grain producers of the world viz. China, the US, France etc. are already facing massive infestation of crop pest and consequent yield losses

Keywords: Emergence Pests, Pink bollworm *Pectinophora gossypiella*, White grub *Holotrichia spp.* Gram pod borer *Helicoverpa armigera*

INTRODUCTION

Climate change has been the talk of the century. Observed shifts in global climatic phenomena and consequent losses have caught the attention of the world. Climate Change can be illustrated as the phenomenon that includes change in environmental factors like temperature, humidity and precipitation over long period of time. Due to increased temperature, elevated CO₂ and other harmful gases, irregular rainfall, global food production is under the threat. Global temperature has been steadily rising since 1900 with an increase of about 1°C since then. A variety of numerical models representing the physical processes in the atmosphere, ocean, cryosphere and land surface simulate the response of the global climate systems to increasing greenhouse gas concentrations and forecast how the climate is expected to change until 2050 and 2070.

According to IPCC, if temperatures rise by about 2°C over the next 100 years, negative effects of global warming would begin to extend to most regions of the world and directly affect most of the organisms on the earth. The climatic variability, together with increase in atmospheric temperature and carbon dioxide, change in precipitation pattern, extended period of drought do have lot of implication in agriculture sector. These climatic variables interact with plants in numerous ways with diverse mechanisms and affect directly in terms of tissue and organ-specific photosynthetic allocation. Such changes in climate also profoundly affect the population dynamics and the status of insect pests (Woiwod, 1997). These effects could either be direct, through the influence of weather on the insects' physiology and behaviour (Samways, 2005, Parmesan, 2007 and Merrill et al., 2008), or may be mediated by host plants, competitors or natural enemies (Harrington et al., 2001 and Bale et al., 2002). In addition, the impacts include changes in phenology, distribution and community composition of ecosystem that finally leads to extinction of species (Walther et al., 2002).

For species to survive in the changing climates, they must either adapt in situ to new conditions or shift their distributions in pursuit of more favorable ones. Many insects have large population sizes and short generation times, and their phenology, fecundity, survival, selection and habitat use can respond rapidly to the climate change. These changes to insect life-history may in turn

produce rapid changes in their abundance and distribution. Increased temperature will cause insect pests to be more abundant and almost all insects will be affected by changes in temperature (Bale et al., 2002). Porter et al. (1991) listed various effects of temperature on insects, including: changes in geographical range, overwintering, population growth rates, number of generations per annum, crop–pest synchronization, dispersal and migration, and availability of host plants and refugia. In-season effects of warming include the potential for increased levels of feeding and growth, including the possibility of additional generations in a given year (Cannon, 1998). This will alter the crop yield, and also influence the effectiveness of insect-pest management practices. Increased global temperature will also influence the phenology of insects including early arrival of insect pests in their agricultural habitats and emergence time of a range of insect pests (Dewar and Watt, 1992; Whittaker and Tribe, 1996, 1998). This will require early and more frequent application of insecticides to reduce the pest damage. Increased temperatures will also increase the pest population, and water stressed plants at times may result in increased insect populations and pest outbreaks. This will affect the crop yield and availability of food grains and threaten food security.

The climatic change impacts on pests may include:

Changes in diversity and abundance of insect pests

Changes in geographical distribution of insect pests

Increased overwintering insects

Rapid population growth and no. of generations

Changes in synchrony between insect pests and their host crops

Introduction of alternative hosts plants

Reduced efficacy of crop protection technologies

Increased risk of invasive pest species

Changes in activity and relative abundance of natural enemies

Impact on extinction of species

Changes in tritrophic interactions

Changes in insect biotypes

Changes in host plant resistance

In recent years several pests have been recorded causing economic damage and consuming more insecticides for keeping the pest below economic threshold level. Insect pests which were important in the past or the minor pests, are likely to become more devastating with global warming and climate change. Many insect species that move to newer areas as invasive pests, also pose a major threat to crop production and food security. There is a need for a greater understanding of pest incidence and their management strategies in the context of changing climate and cropping pattern. The strategy for farmers to follow is to use integrated pest management practices by monitoring insect occurrence.

Emerging Insect Pest

Pink bollworm *Pectinophora gossypiella*

White grub *Holotrichia* spp.

Gram pod borer *Helicoverpa armigera*

Tobacco leaf eating caterpillar *Spodoptera litura*

Cotton mealybug *Phenacoccus solenopsis*

Cotton jassid *Amrasca devastans*

Cotton whitefly *Bemisia tabaci*

Cotton thrips *Thrips tabaci*

Soybean girdle beetle *Obereopsis brevis*

Pink bollworm *Pectinophora gossypiella*

The pink bollworm is one of the most destructive cotton insects known and found throughout the tropics and sub-tropics. In India, it is distributed all over the country and earned the name of the pest of national importance. It can be the dominant yield constraint, but fluctuates considerably between season and locations.

Nature of Damage

The newly hatched larvae bore into squares, buds or bolls. In the beginning of season, larva feeds on buds, flowers and causes their shedding. In squares, larvae complete most of their development before blossoming occurs and often cause rosette blooms whose bolls fail to open. In bolls, larva tunnels into boll under the egg shell or nearby and feeds on the soft inner walls. The entry hole gets closed up as the boll matures and it becomes extremely difficult to locate the infested bolls unless they drop down to the ground. The larva feeds within seeds, moving from seed to seed, the larva causes damage by cutting through the lint with its mouthparts, Lint is also damaged as the larva tunnels out of the boll. The larva eats one to five seeds and soils the lint, causing the arrest of the growth and the rotting or premature and imperfect opening of the boll.

Not only the seeds and the lint actually attacked are lost, but the uninfested parts of the boll are retarded in growth and greatly depreciated in value by the attack of even a single larva. When two or more larvae infest a single boll, the value of the seeds and lint is entirely lowered.

The larva feeds on the inner contents particularly seeds and moves to adjacent locule by making a hole through the septum. As a result, ginning percentage, oil and spinning qualities are adversely affected.

Host Plants: Besides cotton, this pest feeds on okra, ambadi and hollyhock.

Reasons of Outbreak

Increased area under extended crop: In many fields, the crop is extended upto April- May which provided continuous availability of cotton all through the year. Pink bollworm is a winter pest. It causes damage mainly in November, which can be prevented. The pupae enter into diapause in December in the absence of cotton crop or crop residue such as stalks. However, if the crop is available beyond November, the pest continues to survive on the fruiting parts. This extended phase intensified Bt-toxin selection pressure and resistance development was accelerated.

Storage of raw cotton in ginning mills and market: Storage of raw cotton for long period serves as source of infestation in the coming season.

No disposal of crop residue before the season: The pest stages present in crop residue serve as source of infestation.

Large number of Bt hybrids with different durations: Large number of Bt hybrids having different growth periods providing continuous food to pink bollworm.

Limited host range: Besides cotton, pink bollworm survives on okra, ambadi, hollyhock. It is functionally monophagous. This exerts selection pressure and increased resistance development.

No refugia: Most of the farmers did not cultivate refugia.

Segregation of seed: F1 plants harbouring the F1 bolls carry seeds that segregate in the ratio of 9:3:3:1 (Cry1Ac+Cry2Ab in 9; Cry2Ab alone in 3; Cry1Ac in 3 and none in 1). Thus a spectrum of non Bt seeds, seeds with Cry1Ac alone, seeds with Cry2Ab alone and seeds with Cry1Ac+Cry2Ab are present in a single boll. This situation is ideal for resistance development, due to selection of resistance to independent toxins.

Development of resistance: Pink bollworm larvae developed resistance to Cry 1 Ac and Cry 2Ab, Hence the infestation was severe on Bt cotton.

Expression of Bt-toxin: Squares, flowers and developing seeds in young bolls have less Bt-toxin expression. The fertilizer application and irrigation also affects expression of Bt-toxin.

Lack of management activities: The farmers were not aware about incidence of pink bollworm. There were no timely and appropriate management activities.

Management strategies :

Economic threshold level: 1 live larva / 10 green bolls or 8-10 moths/trap/3 consecutive night

After crop harvest

Avoid ratooning or extended crop, terminate the crop upto December.

Allow the animals or goats, sheep for grazing after last picking.

Destruction or utilization of crop residues immediately after crop harvesting. Do not stack cotton stalks in the field or nearby the field.

Installation of light traps and pheromone traps in fields during the season and also near go-downs, ginning mills, market yards etc, to trap post season moths.

Deep ploughing in summer to expose the pest to hot weather or predatory birds.

At the time of sowing

Follow crop rotation. Do not grow okra, ambadi or hollyhock in the field before or after cotton crop.

Planting of refugia. Planting of desi cotton/ conventional non-Bt *Gossypium hirsutum* cotton and late planted bhendi as refugia crops.

Use of short duration hybrids / varieties (150 days) having uniform maturity.

Select sucking pest resistant or tolerant hybrids/ varieties to avoid early insecticide sprayings.

After sowing

Installation of pheromone traps for monitoring of adults

Regular monitoring of green bolls for larvae.

Collection and destruction of rosette flowers, damaged squares and bolls.

Mass trapping of moths by pheromone traps.

Release of the egg parasitoid *Trichogramma bactriae* in cotton fields.

White Grub : *Holotrichia* spp.

(Scarabaeidae: Coleoptera)

White grub is a national pest. The term 'White grubs' is applied to the larvae of the beetles called as 'Leaf chafers' or 'Chafer beetles' or 'May-June' beetles. White grubs initially have been defined as larvae of Melolonthinae but the term has wider usage embracing the larvae of Rutelinae. Dynastinae and other subfamilies of Scarabaeidae, all of which have in general similarity. White grubs are among the most destructive and troublesome of soil insects, threatening the entire crop production. In recent year white grubs are found in different states like Maharashtra, Karnataka, Punjab, Assam, Gujarat, Haryana, Himachal Pradesh, Uttar Pradesh, Tamil Nadu, Bihar, etc. In Maharashtra this pest has become serious problem in Kolhapur, Sangli, Satara, Ahmednagar, Buldhana, Dhule, Jalgaon, Nanded: Osmanabad, Parbhani, Beed, Wardha and some part of Pune districts

Extent of losses

Sugarcane: 80% by *Holotrichia consanguinea* in UP Groundnut 70%

Nature of Damage

The grubs feed on tender roots. As a result, affected plants which turn yellowish may die ultimately. The attacked plants can be easily pulled out from the soil. The withering and drying of plants and one direction in row killing plants in series by single grub (damage in line).

Management strategies

The adults and grubs have different feeding habits and habitats. Hence the management strategies should be planned accordingly.

Management of adults

Deep ploughing in summer to expose the adults to hot sunshine or birds.

During ploughing the exposed adults should be collected and destroyed.

Collection and destruction of adult beetles by vigorous shaking of twigs of trees and bushes.

The adults emerge from soil during evening after sufficient monsoon during March-June and

congregate on the host plants. Such plants should be shaken during 8-9 pm and the adults may be collected and destroyed,

Use of light trap, petromax or lantern collectively by all the farmers of the village near tubewell, huts or on irrigation channels or in the fields near bush or trees at 7.30 to 8.30 pm daily for 7-10 days.

Treat green twigs of neem or other host plants with insecticide and put in the field at several places in the evening wherever feasible so as to attract emerging adult beetles which would die on feeding the foliage.

Management of grub

Use of well rotten FYM. If grubs are found in FYM, the FYM should be treated with insecticide.

Removal and destruction of the weed *Boerhavia diffusa* which harbours early stage of grubs.

Hand picking and destruction of grubs during tillage operations.

Flooding the fields where ever possible to reduce the grub population. This does not allow egg laying to adults or kills the grubs or the grubs go deeper to avoid stagnated water,

Use of *Metarrhizium anisopline* @ 10Kg/ha.

Use of entomopathogenic nematodes. Application of granular insecticide Carbofuran 3 CG 33 Kg/ha at the time of sowing:

Drenching of Fipronil 40%+ Imidacloprid 40% @ 200 ml/ha.

Gram Pod Borer : *Helicoverpa armigera* (Hubner) (Lepidoptera: Noctuid

Helicoverpa armigera (Hubner) (Lepidoptera: Noctuidae) is one of the most serious insect pests in Asia. *H. armigera* is a key pest of cotton, pulses, vegetables and cereals. In India, it has been recorded on more than 181 plant species from 45 plant families. It is the single most important cause of yield losses in several crops. Despite of considerable research efforts, its pest status is actually increasing very fast. Several factors, including increasing levels of resistance to pesticides and rise in cropping intensity has contributed to greater importance of *H. armigera*. Heavy losses because of *H. armigera* damage are mainly due to the feeding preference of the larvae for plant structures that are high in protein content, particularly the reproductive plant structures and growing points, eg, cotton buds and bolls and flower and pods of pulses, corn ears, tobacco buds, sorghum panicles resulting in a direct reduction in the crop yield.

These nitrogen rich structures provide enhanced growth and fecundity relative to feeding on vegetative parts. In absence of reproductive parts, it can survive on vegetative parts. The chief characteristics of *H. armigera* due to which it has attained the status of a major pest are polyphagy, high mobility, high fecundity and a facultative diapause. Frequent outbreaks of *H. armigera* are common in India in different states leading to various social and economical problems.

Pesticide use

Over the years, the consumption of insecticides for *Helicoverpa* control has grown beyond proportions. The cost of insecticides against *H. armigera* may exceed US\$1 billion world wide and US\$127.5 million in India.

Host range

H. armigera is a major pest of cotton, pigeonpea, chickpea, peas, cowpea, sunflower, soybean, tomato, sorghum, pearl millet, groundnut, okra, field beans, lucerne, urid, mung, lentil, tobacco, potato, maize, linseed, fruits (*Prunus*, *Citrus* etc.), forest trees and a range of vegetable crops. A wide range of wild plant species support larval development. Important species in

India include *Hibiscus* spp., *Acanthospermum* spp., *Datura* spp., *Gomphrena celosioides*, *Lagasca* spp., *Parthenium*, *Pethari*

Damage and yield loss

Helicoverpa causes an estimated loss of US \$ 927 million in chickpea and pigeonpeas and possibly over US\$5 billion on different crops worldwide. Cotton: Yield losses from *H. armigera* in cotton have been estimated to range from 10 to 45% on cotton. 2 to 3 larvae per plant can destroy all the bolls within 15 days.

Chemical control of *H. armigera*

H. armigera is well adapted to a variety of crop plants. This pest is relatively difficult to control through cultural practices, natural enemies and host plant resistance. As a result, there is heavy emphasis on chemical control. However, *Helicoverpa* resistance to insecticides has become a problem for cotton and pigeonpea growers in some parts of India & this is the major reason for the greater interest in IPM. *Helicoverpa* management options include the combined use of cultural practices, biological control and need-based chemical control. In the field, sampling and monitoring through pheromone traps have been used to undertake insecticide application at appropriate times.

CONCLUSION

Climate change now a day is globally acknowledged fact. It has serious impacts on diversity, distribution, incidence, reproduction, growth, development, voltinism and phenology of insect pests. Climate changes also affect the activity of plant defense and resistance, bio-pesticides, synthetic chemicals, invasive insect species, expression of Bt toxins in transgenic crops. Considering such declining production efficiency due to depleting natural resource base, serious consequences of climate change on diversity and abundance of insect-pests and the extent of crop losses, food security for 21st century is the major challenge for human kind in years to come. Being a tropical country, India is more challenged with impacts of looming climate change. In India, pest damage varies in different agro-climatic regions across the country mainly due to differential impacts of abiotic factors such as temperature, humidity and rainfall. This entails the intensification of yield losses due to potential changes in crop diversity and increased incidence of insect-pests due to changing climate. It will have serious environmental and socio-economic impacts on rural farmers whose livelihoods depend directly on the agriculture and other climate sensitive sectors.

Climate change has serious impacts on diversity, distribution, incidence, reproduction, growth, development, voltinism and phenology of insect pests. Increasing global temperature, disturbed rainfall patterns, modified gaseous composition etc. can cause increase in population and activity of insect pests. This condition has put forward newer challenges for food security affecting the quality and quantity of agricultural products. However, the climate change acts differently on different species, overall impacts of climate change seems to increase the pest population along with their activity and consequent damage in agriculture. Abundance of such insect pests has already been showing serious impacts on global food production.

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