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Jammu, J&K, India

Agricultural & Environmental Technology Development Society (AETDS) U. S. Nagar, Uttarakhand, India

International Conference

Clobal Perspective in Agricultural and Applied Sciences for Food and Environmental Security (GAAFES-2019)

December 1-2, 2019

Vol 1

Editors :Dr. Wajid HasanDr. C. P. SinghDr. P. C. ChanyalDr. Sanjay SwamiDr. Huma NazDr. Hrikesh Singh Yadav

Venue: UCG-HRDC Hall, Kumaun University, Nainital, Uttarakhand, India E-Mail: gaafesconference@gmail.com, Website: www.agetds.com

INTERNATIONAL CONFERENCE

Global Perspective in Agricultural and Applied Sciences for Food and Environmental Security (GAAFES-2019)

First Edition 2019

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Agricultural & Environmental Technology Development Society (AETDS) U. S. Nagar, Uttarakhand, India

International Conference

Global Perspective in Agricultural and Applied Sciences for Food and Environmental Security (GAAFES-2019)

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डॉ अरविन्द कुमार कुलपति Dr Arvind Kumar Vice-Chancellor

रानी लक्ष्मी बाई केन्द्रीय कृषि विश्वविद्यालय

ग्वालियर रोड, झांसी 284 003 (उत्तर प्रदेश) भारत

Rani Lakshmi Bai Central Agricultural University

Gwalior Road, Jhansi 284 003 (U.P.) India

Phone : 0510-2730777 E-mail : vcrlbcau@gmail.com Website : www.rlbcau.ac.in

Dated: 15th November, 2019

MESSAGE

I am delighted to learn that Agricultural and Environmental Technology Development Society (AETDS), U.S. Nagar, UK, India, in collaboration with Faculty of Agriculture (FOA), Agriculture and Forestry University, Chitwan, Nepal and Department of Geography, D.S.B. Campus, Kumaun University, Nainital, UK, India and in association with National Gladiolus Trust (NGT) Jammu, J&K, India is organizing International Conference on Global Perspective in Agricultural and Applied Sciences for Food and Environmental Security (GAAFES-2019)from 1st o 2nd December 2019 at Kumaun University, Nainital, UK, India.

Global food security threatened by climate change is one of the most important challenges in the 21stcentury to ensure food and nutritional security for the ever increasing population while sustaining the already stressed environment. Climate change has already caused significant global impact on water resources, food security, hydropower and human health. Studies on climate impacts and adaptation strategies are increasingly becoming major areas of scientific concern. In recent years, more and more attention has been paid to the risks associated with climate change, which will increase uncertainty with respect to food production and environmental security.

I am confident that this International Conference will deliberate on all the related issues and will come out with the recommendation which will be helpful in optimum management of natural resources for ensuring food and environmental security, and formulate future strategies to meet challenges of climate vulnerability with reference to agriculture.

I extend my best wishes to delegates and the organizers for grand success of this mega event.

(Arvind Kumar)

Camp Office: Room No. 213, KAB-II, Pusa, New Delhi 110 012 Ph: (O) 011-25846034



कुमाऊँ विश्वविद्यालय, नैनीताल

स्लीपी हौलो, नैनीताल– 263001, उत्तराखण्ड, (भारत)

Kumaun University, Nainital,

Sleepy Hollow, Nainital- 263001, Uttarakhand, (India) (Accredited "A" Grade by NAAC)

प्रो0 के0एस0 राना कुलपति

Prof. K.S. Rana M.M.Sc., Ph.D., D.Sc., F.Z.S. (London) Vice- Chancellor e-mail : vc@kunainital.ac.in Tel : +91-5942-235068 Resi : +91-5942-236855 Mob.: +91-8979299999 Fax : +91-5942-235576



From the Desk of Chief Patron

I am delighted to learn that Agricultural & Environmental Technology Development Society (AETDS), U.S. Nagar, UK, India and Faculty of Agriculture (FOA), Agriculture and Forestry University, Chitwan, Nepal and The Department of Geography, D.S.B. Campus, Kumaun University, Nainital, UK, India in association with National Gladiolus Trust (NGT) Jammu, J&K, India is organizing International Conference on Global Perspective in Agricultural and Applied Sciences for Food and Environmental Security (GAAFES-2019) from 1st to 2nd December 2019 at Kumaun University, Nainital, UK, India.

Global food security threatened by climate change is one of the most important challenge in the 21st century to supply sufficient food for the increasing population while sustaining the already stressed environment. Climate change has already caused significantly damaged air, water resources, food security, hydropower, human health to the whole world. Studies on climate impacts and adaptation strategies are increasingly becoming major areas of scientific concern. In recent years, more and more attention has been paid to the risk associated with climate change, which will increase uncertainty with respect to food production and environmental security.

I am confident that this International Conference will deliberate on all the related issues and will come out with the recommendation which will be helpful in optimum management of natural resources for ensuring food and environmental security, and formulate guidelines to meet challenges of climate change with reference to agriculture.

I extend my best wishes to delegates and the organizers for grand success of this mega event.

Prof. K.S. Rana Vice Chancellor



Shobhit Institute of Engineering & Technology (A NAAC Accredited Deemed to-be University) NH-58, Modipuram, Meerut 250110, INDIA T.: 0121 2575091; F.: 0121 2575724 E.: mail@shobhituniversity.ac.in U.: www.shobhituniversity.ac.in

Amar P. Garg

M.Sc., Ph.D., LL.B. F.B.S., F.P.S.I., F.S.M.P., M.N.A.Sc., F.N.R.S. CAS Fellow (U.K.), DAAD Fellow (Germany) Ex Professor & Head, C.C.S. University, Meerut Ex-PVC, JNU, Jaipur Vice Chancellor, Shobhit University, Meerut e-mail: <u>vicechancellor@shobhitmeerut.ac.in</u> amarprakashgarg@yahoo.com

Mobile: 7617505011, 8077633273

Date: 13 November, 2019



I am delighted to know that the Agricultural & Environmental Technology Development Society (AETDS), U.S. Nagar, Uttarakhand, India is organizing two-day International Conference on "Global Perspective in Agricultural and Applied Sciences for Food and Environmental Security (GAAFES-2019)" in collaboration with Department of Geography, Kumaun University, Nainital, Uttarakhand, India and Agriculture and Forestry University (AFU), Chitwan, Nepal on December 1-2, 2019 at UGC-HRDC Hall, Kumaun University, Nainital,

Uttarakhand, India. The conference will provide an excellent opportunity for active interaction with great international Professors, prominent agriculturists and environmentalists. The theme of the conference is based on ambitious goal of our Hon'ble Prime Minister for "doubling farmer's income by 2022". The food security, environmental safety, conservation of natural resources and organic farming are the key issues to be discussed and addressed by the international scientific community. The Society's goals are well defined in the conference and I am quite confident that the participants will get brain storming sessions and they will take fullest advantage of the presence of galaxy of scientists.

I wish all success to the organizers.

(Prof. Amar P. Garg) Vice-Chancellor कृषि तथा वन विज्ञान विञ्वविद्यालय कृषि संकार डीनको कार्यालय रामपुर, चितवन, नेपाल प.सं./Ref. No. च.नं.



Agriculture and Forestry University **Faculty of Agriculture** Office of the Dean Rampur, Chitwan, Nepal

मिति/Date: 4th NOV., 2019



Message

I am very much pleased to know that the international conference on Global Perspective on Agricultural and Applied Science for Food and Environmental Security (GAAFES-2019) is going to be organized by Agriculture and Environmental Technology Development Society (AETDS), U. S. Nagar, Uttarakhand, India in collaboration with Department of Geography, Kumaun University, Nainital, Uttarakhand, India and Agriculture and Forestry University (AFU), Chitwan, Nepal on December 1-2, 2019 at UGC-HRDC Hall, Kumaun University, Nainital, uttarakhand, India. Renowned Researchers, Scientists, technocrats and students from regions well share and discuss their latest research finding, development activities in the area agricultural and all applied science which will boost their knowledge and experiences in the concerned field.

I have a strong believe that, this conference is being organized as timely the Asia region including Nepal has given high priority for increasing agriculture production and concerning environment while adopting improved agricultural practices. Government of Nepal and Agriculture and Forestry university have focused on research, program and plans related to eco-friendly measures. Hence, the outcomes of this program would be very useful in shaping the future policies and program. This will be equally important in achieving the targets of food and nutrition seriously. I hope the deliberations in the conference shall dwell on various dimensions in these important areas so as to open up new vistas of research.

I convey my good wishes to the organizers for the grand success of the conference

Prof. Jay Prakash Dutta Dean Faculty of Agriculture Agriculture and Forestry University, Chitwan - Nepal

टेलिफोन : +४७७-५६-५४११४१, ५२०६०२/फ्याक्स: +४७७-५६-५२०६०२, ५४१०२१ Tel.: +977-56-591141, 520602 / Fax : +977-56-520602, 591021

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उत्तराखण्ड जैवप्रौद्योगिकी परिषद् UTTARAKHAND COUNCIL FOR BIOTECHNOLOGY

Department of Agriculture, Govt. of Uttarakhand Biotech Bhawan, Haldi-Pantnagar-263146, U.S.Nagar, Uttarakhand (India) Tel. /Fax: 05944-230567 (O);+91-9412931556 Email: directorucb@gmail.com; statebiotech@rediffmail.com



Prof.(Dr.) D.K. Singh M.Sc., Ph.D, IPGC-Israel, Fellow ISVS, HSI & CHI Director Ref: UCB/Hld / 07

MESSAGE

I am intensely delighted that Agriculture & Environmental Technology Development Society (AETDS), U. S. Nagar, Uttarakhand, India is organizing an international Conference on "Global Perspective in Agriculture and Applied Sciences for Food and Environmental Security (GAAFES-2019)" in collaboration with Department of Geography, Kumaun University, Nainital, Uttarakhand, India and Agriculture and Forestry University (AFU), Chitwan, Nepal on December 1-2, 2019 at UGC-HRDC Hall, Kumaun University, Nainital, Uttarakhand, India and also bringing out a souvenir on this occasion.

Considering, the gigantic pressure of population on limited Agriculture resources in the developing countries leads to ecological imbalance and threat to the existence of life on earth. Before anything deteriorates, it is mandatory to focus on various problems and challenges faced by the respective workers like Global scientific community, policy makers, administrators, industry representatives and other stake holders and their solutions are meeting the domestic and export demands or not. There is a need for promoting farmers friendly location specific production system management technologies in a concerted manner to achieve a vertical growth in agriculture production ensuring quality of produce and better remuneration with judicious use of natural resources. We will also have to move fast to adopt new technologies including biotechnological intervention that may help us to stay competitive in the world market.

It is hoped that the contemplation at the International Conference will bring up pragmatic and realistic approaches and also clarify the steps needed for the unified development on this sector towards conservation of natural resources.

On this particular event, I convey my warm greetings and best wishes to the organizers and participants for the success of the conference.

(D. K. Singh)

Uttarakhand Council for Biotechnology, Premnagar, Silk Park, Dehradun-248007, Uttarakhand Tel./Fax:0135-2772299



NATIONAL GLADIOLUS TRUST

419-B/2, Vinayak Nagar, Upper Muthi Jammu (J&K)-181 205 Mobile : 09622042000 E-mail: editorgardenglory@gmail.com

Dr. MANOJ NAZIR PRESIDENT 9622042000

SUSHMA AMBARDAR ADVISOR 9718839543

Dr. BALAJI.S.KULKARNI vice-president 94493045950

KESAR DURANI TRUSTEE 9906000604

TAJ KRISHNAN BHAT TRUSTEE 9419126921

SANJAY BHAT TRUSTEE 9419126921

PROF.V.L.SHEELA TRUSTEE 9446703786

Dr.D.DHANASEKARAN PUBLICITY SECRETARY 9843979717

SHIVANI GANJOO JOINT SECRETARY 9091969717

MESSAGE



I am very pleased to know that InternationConference on GLOBAL PROSPECTIVE IN AGRICULTURAL AND APPLIED SCIENCES FOR FOOD AND ENVIRONMENTAL SECURUTY (GAAFES-2019) is being organised by AETDS-Uttrakhand, India from 1st to 2nd December, 2019.

The theme of the International Conference is very tropical and highly relevant in the present scenario.

I firmly beleive that deliberations in this Conference will sensitize the researchers to work on this subject and recommendations if highlighted, I am sure, would be of great help and relief for the majority of the poor and marginalized farmers of our country.

My best wishes and greetings to all the participants and the organizing committee and wish the event Good Luck and Grand Sucess.

Dr.Manoj Nazir Chief Scientist Floriculture

Agricultural & Environmental Technology Development Society (Regd.) AETDS, U.S. Nagar, UK, India

(Registration No. UK06708052019001367, Under the Registration Act No. 21, 1860) www.agetds.com, Email: dr.cpsingh29@gmail.com, secretary@agetds.com, Mob: +91 70055691943

Ref: AETDS/SO/102

Dr. C.P. Singh

President



MASSAGE

It's a matter of great pleasure that the Agricultural & Environmental Technology Development Society (AETDS), U.S. Nagar, UK, India organizing International conference "Global Perspective in Agricultural and Applied Sciences for Food and Environmental Security (GAAFES-2019)" on 1-2 December, 2019 at UGC-HRDC Hall, Kumaun University, Nainital, UK, India with the collaboration with Faculty of Agriculture (FOA), Agriculture and Forestry University, Chitwan, Nepal, Department of Geography, D. S. B. Campus, Kumaun University, Nainital, UK, India, Uttarakhand and Council for Biotechnology, Biotech Bhavan, U.S.Nagar, Haldi, Uttarakhand in association with National Gladiolus Trust (NGT) Jammu, J & K, India.

In this context emphasis will be on novel tools and technologies in the field of Agricultural and Allied Science, Medical Science, Social Sciences, Biological and physical Sciences. This conference will bring together Global scientific community, policy makers, administrators, industry representatives and other stake holders to exchange and share their experiences, new ideas. It will be an opportunity of sharing our expertise and experience with the renowned speakers from all over the world. It will also be a platform to strengthen the friendship and collaboration among the scientists, academia and the institutes. The various subthemes of the conference will offer many opportunities to delegate to learn new things and apply the same in their respective work place.

I am very happy to organizing the International Conference GAAFES-2019 on current issues pertinent to Agricultural and Applied Sciences management.

I welcome all delegates to Kumaun University, Nainital and wish the conference a grand success.

cit.

(Prof. C. P. Singh) Conference Director & President AETDS Former Prof. GBPUAT, Pantnagar Date: 15.11.2019



01336-252229, 251665, 252107 गोचर महाविद्यालय, रामपुर मनिहारान, सहारनपुर GOCHAR MAHAVIDYALAYA, RAMPUR MANIHARAN, SAHARANPUR (U.P)

Dr. Harikesh Singh Associate Professor, Entomology Gochar Mahavidyalaya, Rampur Maniharan-247151 Saharanpur, Uttar Pradesh, India



Message from Organising Chairman's Desk

It is a joy and privilege to welcome you all as Organising Chairman of this International conference on Global Perspectives in Agricultural and Applied Sciences for Food and Environmental Security (GAAFES-2019) at Kumaun University, Nainital, Uttarakhand, India. The objective of this conference is to provide a concrete platform which will encourage and support Scholars, Researchers, Farmers and Industry Professionals to carry and accomplish their research targets.

I am indeed happy to chair this conference which is our most expected project of this academic year. I hope the platform that we have created for learning from each other and sharing the core ideas in different expertise fields will also be launching pad for the solutions of challenging issues of food and environmental security of the world especially developing countries like India who are fighting with exponential population growth. I hope the deliberations, the interactions, exchange of knowledge and collaborations amongst the world's leading experts in these domains will provide a roadmap for the "Vision-2050".

I take this opportunity to congratulate the organising team for the relentless efforts taken to run the show in the most befitting way. I must consider this occasion as a special privilege to sincerely thank the AETDS society for chairing this event and fruitfully supported to carry this endeavour. Further I thank all the resource persons who have done wonderful deliberations during the sessions.

I hope that all delegates will have very comfort, entertaining and educational stay during conference at Nainital and the shared ideas and skills can be used constructively for the betterment of mankind.

Dr. Harikesh Singh



Dr. Sanjay-Swami

School of Natural Resource Management, College of Post Graduate Studies in Agricultural Sciences (CPGS-AS) (Central Agricultural University) Umiam-793 103 Meghalaya, India E-Mail: sanjayswamionline@gmail.com sanjayswamionline@yahoo.com Cell: + 91-94-191-57291



From The Desk of Organizing Convener

It is indeed a matter of great pride for me in organizing the International Conference on Global Perspective in Agricultural and Applied Sciences for Food and Environmental Security (GAAFES-2019) from 1st to 2nd December 2019 at Kumaun University, Nainital, UK, India under the patronage of Agricultural & Environmental Technology Development Society (AETDS), U.S. Nagar, UK, India in collaboration with Faculty of Agriculture (FOA), Agriculture and Forestry University, Chitwan, Nepal and Department of Geography, D.S.B. Campus, Kumaun University, Nainital, UK, India and in association with National Gladiolus Trust (NGT) Jammu, J&K, India.

Food security 'exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life.' It is determined by four major factors: availability from agricultural production and land-use or exchange; stability of supplies e.g. seasonally and from year to year; access dependent on financial means but also physical access and social factors; and biological utilization of food e.g. nutritional diversity and food safety issues. Attaining the twin goals of food and environmental security in the coming decades poses a significant sustainability challenge. Providing affordable food and energy to consumers suggests a strategy of cropland expansion, as the world seeks to feed more than 9 billion people in 2050. However, the desire to raise productivity and yields has led historically to environmental degradation, reduced biodiversity and limitations to ecosystem services, with the greatest impacts falling upon the poor. Millennium Development Goal (MDG) number 1 (eradicate hunger and poverty) is effectively coupled to many of the other MDGs. It is imperative that we develop mechanisms to meet MDG 1 and other goals that are complementary. For example, sustainable intensification (SI) of agriculture has been proposed as a way to address hunger while also minimizing further environmental impact. Addressing MDGs in isolation can, therefore, be at the expense of others, and improved integration of actions is required.

I hope that this International Conference will provide an excellent platform for deliberations and to evolve a road map for ensuring food and environmental security under climate change scenario.

I wish the International Conference a grand success.

(Sanjay Swami)



Agricultural & Environmental Technology Development Society

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Ref: AETDS/SO/101

Date: 01.12.2019



From The Desk of Chief Organizing Secretary

It is a matter of great privilege for me to organize the International conference "Global Perspective in Agricultural and Applied Sciences for Food and Environmental Security (GAAFES-2019)" on 1-2 December, 2019 at UGC-HRDC Hall, Kumaun University, Nainital, UK, India is going to be jointly organized by Agricultural & Environmental Technology Development Society (AETDS), U.S. Nagar, UK, India in collaboration with Faculty of Agriculture (FOA), Agriculture and Forestry University, Chitwan, Nepal; Department of Geography, D. S. B. Campus,, Kumaun University, Nainital, UK, India Uttarakhand and Council for Biotechnology, Biotech Bhavan, U.S.Nagar, Haldi, Uttarakhand in association with National Gladiolus Trust (NGT) Jammu, J & K, India.

On behalf of organizing committee, I warmly welcome all participants, deligates, researchers, scientist, students from different institutions, colleges and universities from India and abroad.

GAAFES-2019 has been designed to focus on various scientific tracks covering major areas of research on agriculture, biological and applied sciences. In this context emphasis pointed on novel tools and technologies in the field of Agricultural and Allied Science, Medical Science, Social Sciences, Biological and physical Sciences. This conference will bring together Global scientific community, policy makers, administrators, industry representatives and other stake holders to exchange and share their experiences, new ideas. It will be an opportunity of sharing our expertise and experience with the renowned speakers from all over the world. It will also be a platform to strengthen the friendship and collaboration among the scientists, academia and the institutes.

The organizing committee has been very active and arrangements are well under way to ensure that International conference GAAFES-2019 on 1-2 December, 2019 is resounding success. I appeal to the research community to extend their continued support and cooperation to the future activities of AETDS. I look forward to welcoming you all in the UGC-HRDC Hall, Kumaun University, Nainital, UK, India and pray almighty to bless us for making GAAFES-2019 a grand success.

(Dr. Wajid Hasan) Chief Organizing Secretary, **GAAFES-2019** Secretary, AETDS, Society Email: gaafesconference@gmail.com, Mob. 7004942581

Kumaun University, Nainital Department of Geography

Dr. P.C. Chanyal

(Assistant Professor) & Coordinator EDUSAT Program (IIRS-ISRO) Kumaun University, Nainital Contacts: + 91 9690 659365



Department of Geography (D.S.B. Campus) NAINITAL – 263 002 Uttarakhand, INDIA

Email:chanyalpc.geogkuntl@gmail.com



From The Desk of Organizing Secretary's

Honored and revered participants,

It is our great pleasure to warmly invite you to the International Conference on Global Perspective in Agricultural and Applied Sciences for Food and Environmental Security (GAAFES-2019) from 1st to 2nd December 2019. The Geography Department, D.S.B. Campus, Kumaun University, Nainital, UK, India collaboration with Agricultural & Environmental Technology Development Society (AETDS), U.S. Nagar, UK, India and Faculty of Agriculture (FOA), Agriculture and Forestry University, Chitwan, Nepal are organising this mega event in the Himalayan lake city Nainital. These two days international conference is designed to provide and share the scientific information and developments on Agriculture, Environment and Food security to all the researchers, culturists and academicians who are involved in these disciplines. This mega-conference highlights numerous scientific discoveries and major milestones in innovative approaches in agricultural and allied science, Natural Resources Management, Food and Environmental Security, Applications of Remote Sensing and satellite data, recent trends in engineering and technologies globally and locally.

The need of the hour is the one of the measure challenge becomes to provide the humanity friendly environment and adequate outlay of education, skill development and grass-root awareness outlays to fight climate change, soil and land degradation, natural and man-made hazards, pollution and exploitation of natural resources. I look forward to accountable and sensitize to academicians, researchers, agrarians, planners and governance for Himalayan regions which is a home of hope for human life through such as wonderful scientific platform. The need of the hour is an adequate outlay of education, skill development and grass-root awareness outlays to fight climate change, soil and land degradation, natural and man-made hazards, pollution, exploitation of natural resources and the poisonous food.

We are confident that you will enjoy a stimulating conference here in Nainital and your presence and participation will help contribute to this vibrancy and enrich discussions around the themes, developing professional knowledge exchange, insights and collaborations.

I sincerely hope that this conference will deliberate on various issues that need to be addressed while increasing production and come up with recommendations that will lead to sustainably increasing production without leaving its ecological footprint.

Dr. (P.C. Chanyal) Organizing Secretary, GAAFES-2019



Agricultural & Environmental Technology Development Society

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Message from Organising Secretary's Desk

It gives me immense pleasure to welcome you all as an Organising Secretary of International Conference "Global Perspective in Agricultural and Applied Sciences for Food and Environmental Security (GAAFES-2019)" on 1st-2nd December, 2019, that is being organized by The Agricultural & Environmental Technology Development Society (AETDS), U.S. Nagar, UK, India. at UGC-HRDC Hall, Kumaun University, Nainital, UK, India in collaboration with Faculty of Agriculture (FOA), Agriculture and Forestry University, Chitwan, Nepal, Department of Geography, D. S. B. Campus, Kumaun University, Nainital, UK, India, Uttarakhand and Council for Biotechnology, Biotech Bhavan, U.S.Nagar, Haldi, Uttarakhand in association with National Gladiolus Trust (NGT) Jammu, J & K, India.

The conference will provide an excellent opportunity for active interaction with great International Professors, Scientists, prominent Agriculturists and Environmentalists. The greatest challenge of today's agriculture is to feed the growing population and restore the natural resources. Global food production needs to be doubled by 2020 and just to maintain the present precipitate food consumption. Though by virtue of chemical fertilizers the production and productivity of crops has increased, the increased use of pesticides has posed many environmental and health problems. The chemical fertilizers and pesticides used over a long period of time have adverse toxic effects on the production potential of the land and the ultimate consumers of the products. The food security, environmental safety, conservation of natural resources and organic farming are the key issues to be discussed and addressed by the International Scientific Community. The various subthemes of the conference will offer many opportunities to delegate to learn new things and apply the same in their respective work place. It will also be a platform to strengthen the friendship and collaboration among the scientists, academia and the institutes.

I would like to express my greetings and warm welcome as an Organising Secretary to everyone who are contributing with their participation, help and interest in the success of this conference.

(Dr. Huma Naz)

OrganizingSecretary(AETDS)

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LEAD PAPERS

Global Perspective in Agricultural and Applied Sciences for Food and Environmental Security (GAAFES-2019)

INFECTION INDEXING OF SEED-BORNE FUNGI IN SORGHUM GERMPLASM FROM INDIA

JAMEEL AKHTAR, PARDEEP KUMAR, RAJ KIRAN, MEENA SHEKHAR, SUSHEEL PANDEY¹, SADHANA SMITA LENKA JAIN¹ AND SC DUBEY

DIVISION OF PLANT QUARANTINE, ICAR-NATIONAL BUREAU OF PLANT GENETIC RESOURCES, NEW DELHI-1100121

¹DIVISION OF GERMPLASM CONSERVATION, ICAR-NATIONAL BUREAU OF PLANT GENETIC RESOURCES, NEW DELHI-110012

Sorghum (*Sorghum vulgare* Pers.), an important *rabi* cereal, is the 5th most important cereal crop after wheat, rice, maize and barley grown throughout world. Studies on the fungal diseases from different parts of the world have established that sorghum seed is carrier of many destructive diseases such as anthracnose, seed/stalk rot, era-rot, target spot, ergot, seedling blight/charcoal rot, leaf spot and blight, downy mildew, loose smut, covered smut, head smut, long smut, etc., which cause deterioration in seed quality as well as considerable yield losses. Therefore, association of so many pathogenic fungi reported in/on sorghum seed realized the need of seed health testing to study their distribution profiling and status of seed-borne infection in indigenous sorghum germplasm.

Keywords: Seed borne fungi, sorghum, Germplasm, Blotter method.

Introduction: Sorghum (Sorghum vulgare Pers.), an important rabi cereal popularly known as 'Jowar' in India, is the 5th most important cereal crop after wheat, rice, maize and barley grown throughout world. It is cultivated in the arid and semi-arid parts of the world including India. Due to extremely drought tolerant feature, sorghum could be a contingent crop under climate changing scenario. But, studies on the fungal diseases from different parts of the world have established that sorghum seed is carrier of several destructive diseases such as anthracnose (*Colletotrichum graminicola*), seed/stalk rot (*Fusarium verticillioides* [syn: *F. moniliforme*]), target spot (*Bipolaris sorghicola*), ergot (*Claviceps sorghi*), seedling blight/charcoal rot (*Macrophomina phaseolina*), leaf spot and blight (*Phoma sorghina*), downy mildew (*Sclerospora sorghi*), loose smut (*Sphacelotheca cruenta*), covered smut (*S. sorghi*), head smut (*S. reiliana*), long smut (*Tolyposporium ehrenbergii*) etc. which cause considerable yield losses (Islam *et al.*, 2009). Richardson (1990) also documented 44 fungal species belonged to 29 genera as seed-borne in sorghum. Therefore, presence of so many pathogenic fungi reported in/on sorghum seed realized the need of seed health testing to study mapping and distribution of seed-borne fungi of sorghum germplasm in India for contributing towards developing resistant varieties against different diseases using breeding strategies.

Materials & Methods: Seed health testing of 2235 sorghum germplasm samples received from Germplasm Conservation Division, National Bureau of Plant Genetic Resources (NBPGR), New Delhi, India was carried out at the Division of Plant Quarantine, NBPGR. During seed-health testing, all the seed samples were first examined visually and then under stereo-binocular microscope for discoloration, deformation, malformation and fungal growth and fructification etc. Later, seeds were subjected to blotter test by placing the seeds on 3 layers of moist blotter paper in plastic petriplates and incubated at $20\pm1^{\circ}$ C under fluorescent light in alternating cycles of 12 h light and darkness for 7 days and examined on 8th day under stereo-binocular microscope (Nikon - SMZ 1500) to detect the presence of seed-borne fungi (Mathur and Kongsdal 2003). Fungi were identified on the basis of colony characters, fruiting bodies and spores under stereo-binocular microscope and slides were also prepared and examined under compound microscope (Nikon - Eclipse 80i), whenever required and the infection index was derived from frequency of occurrence and effect of infection on seed germination was also recorded.

Results & Discussion: Studies on seed-borne fungi of 8835 indigenously multiplied accessions of sorghum revealed association of 31 fungal species belonging to 16 genera namely Alternaria alternata, A. padwickii, Aspergillus flavus, Biopolari B. bicolar, B. halodes, B. longirostrata, B. oryzae, B. rostrata, B. sorghicola, B. sorokiniana, B. specifera, B. tetramera, Cephalosporium maydis, Chaetophoma sp., Cladosporium sphaerospermum, Colletotrichum graminicola, Curvularia lunata, C. trifolii, Fusarium oxysporum, F. poae, F. semitactum, F. solani, F. verticillioides, Gloecercospora sorghi, Melnasopora zamei, Myrothecium verrucaria, Phoma sorghina, Phomopsis sp., Rhizoctonia solani and Sphacelotheca sorghi as seed-borne fungi and their effect on seed germination. Among fungi identified on sorghum seed, F. verticillioides was most predominant fungus recovered from 178 accessions with infection ranging 10.00 to 100.00 per cent followed by B. rostrata with infection ranging 10.00 to 100.00 per cent in 42 accessions. Out of total germplasm accessions tested, one accession, IC287629 with no seed germination yielded maximum number of fungi (8 species) which included B. sorghicola, B. tetramera, C. sphaerospermum, C. graminicola, C. trifolii, F. verticillioides, F. semitactum and Phoma sorghina. Among the 31 fungi detected in sorghum seed samples, infection index of F. verticillioides was highest (17.2%) followed by Alternaria alternata (15.9%), C. lunata (13.7%), A. flavous (13.0%), C. sphaerospermum (11.5%) B. rostrata (6.9%) and C. graminicola (6.3%). In this study, F. verticillioides was found most responsible for inhibition of seed germination (100.00 %) on blotter.

Conclusion: Studies on seed mycoflora of sorghum germplasm revealed the presence of 31 fungal species belonging to 19 genera. Out of these, *Aspergillus flavous, B. sorghicola, F. verticillioides P. sorghina, C. trifoli* and *C. lunata* were recorded as dominant species with varying level of infection in sorghum germplasm. Most of these fungi have been reported as being associated with sorghum in India (Akhtar *et al.*, 2012, Panchal and Dhale, 2011) and in other parts of the world (Islam *et al.*, 2009). Germplasm is also exchanged nationally/internationally in the form of seed for varietal improvement as it provides a wide genetic diversity available worldwide. Due to their high mobility, seeds may disseminate plant pathogens including fungi which are associated with seed. Thus, keeping in view the importance of sorghum as a probable contingent crop under climate changing scenario, the present findings may play greater role in developing strategies to ensure quality seed with greater protection from crop losses in field as well as for short and long-term sorghum conservation.

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MANAGING NATURAL RESOURCES IN CHANGING CLIMATE SCENARIO

¹SANJAY-SWAMI AND ²WAJID HASAN

¹SCHOOL OF NATURAL RESOURCE MANAGEMENT, COLLEGE OF POST GRADUATE STUDIES IN AGRICULTURAL SCIENCES, CENTRAL AGRICULTURAL UNIVERSITY, UMIAM (BARAPANI)-793 103, MEGHALAYA, INDIA ²KRISHI VIGYAN KENDRA, JEHANABAD, BIHAR AGRICULTURAL UNIVERSITY, SABOUR, INDIA

Global food security threatened by climate change is one of the most important challenges in the 21st century to supply sufficient food for the increasing population while sustaining the already stressed environment. Climate change can entail an increase in climatic variability, extreme events and shocks, and threaten livelihood security of millions of people. Its impacts are cross cutting in all sectors and walks of life. Agriculture sector (crop and livestock production, fisheries and forestry) is among the most vulnerable sectors to the impacts of climate change. Agriculture sector is also directly responsible for about 30% of GHGs yearly emissions globally (IPCC, 2007a). It also triggers deforestation and land degradation which additionally account for 17% GHGs emission. Global population continues to grow rapidly. With increased life expectancy, world population is projected to increase by 50% from now, i.e. from 7.4 to 9.2 Bn, by 2050, and Indian population from 1.3 to 1.8 Bn. Considering food needs of increased population, livestock and poultry, India would require around 350 MT of food grains during 2050, while the food-grain production currently is revolving around 260-270 Mt. Natural resources are shrinking and food demand is increasing. Management strategies under this scenario must aim at climate-smart agriculture with prime focus on natural resource management.

Why is Climate Changing?

Climate change is the resultant of primarily two types of phenomena: Natural and anthropogenic. The natural processes take place at global scale, while human-induced processes occur at local, regional or national scale.

The natural processes like changes in the sun's intensity, gradual change in the direction of the earth's axis around the sun (i.e. earth's precession), volcanic eruptions, continental drifts resulting in changes in the physical features and position of the landmass and water bodies, changing direction and velocity of ocean currents, etc. are responsible for climate change in the long run.

The anthropogenic influences (i.e. human influences) also have a strong and immediate impact on the surrounding climate. Human influence on the global climate began around 8,000 years ago with the start of forest clearing to provide land for agriculture, and 5,000 years ago with the start of Asian rice irrigation (William Ruddiman, Paleoclimatologist). The pace of climate change, however, increased after the industrial revolution of 18th century, beginning around 1760, and is continuing even today.

The unchecked emission of green house gases (GHGs) is mainly responsible for raising earth's temperature and climate change (IPCC, 2007). Carbon dioxide has contributed more than any factor to climate change (global warming) between 1750 and 2011. Other gases although are more potent in heat trapping than CO₂ (e.g. methane), yet they are simply far less abundant in the atmosphere; hence, CO₂ dominates in greenhouse effect. Methane (CH₄) traps far more atmospheric heat than carbon dioxide. It can warm the planet 86 times as much as CO₂ before it decays into CO₂. Methane's global warming effects last only a few decades compared to CO₂ which remains in the atmosphere for centuries. The greenhouse effect of different GHGs is shown in Table 1.

Table 1: Greenhouse effect of different GHGs (IPCC, 2014)

Greenhouse Gas	How produced	Greenhouse
		effect (%)
Carbon Dioxide (CO ₂)	Emitted due to burning of fossil fuels (oil, natural gas, and coal), solid	76
	deforestation and soil degradation add carbon dioxide to the atmosphere,	
	while forest re-growth takes it out of the atmosphere.	
Methane (CH ₄)	Emitted during livestock and agricultural practices, the anaerobic decay	16
	of organic waste in municipal solid waste landfills, energy use	
Chloroflourocarbons	Emitted from a variety of industrial processes and commercial and	2
(CFCs)	household uses like referigeration; and do not occur naturally.	
Nitrous Oxide (N ₂ O)	Emitted during agricultural and industrial activities (a gaseous	6
	intermediate in the reaction sequence of denitrification and a by-product	
	of nitrification); during combustion of fossil fuels and solid waste.	

The period since industrial revolution has seen large-scale use of fossil fuels for industrial and transport activities, increased agricultural activities to feed increasing population, increased fertilizer production and consumption, increased deforestation, land clearing, road construction, urbanization and other developmental activities, generation and piling-up of large quantities of industrial and house-hold waste etc. All these activities have lead to production of greenhouse gases, and pollution and degradation of natural resources.

Estimates suggest that about 3/4th of the carbon dioxide, 1/5th of the methane emissions and a large quantity of nitrous oxide are contributed by energy and transport sectors which consume large quantities of fossil fuels such as oil, coal and natural gas. Over 60% of global methane emissions come from human activities such as industry, agriculture, and waste management. About 1/4th of all methane comes from domesticated animals such as dairy cows, goats, pigs, buffaloes, camels, horses, and sheep; methane is produced during the cud-chewing process. Methane is also released from flooded rice fields during anaerobic decomposition of soil organic matter. Nearly 90% of world's rice is grown in Asia.

Relative contribution of different economic sectors towards global GHGs emission is shown in Table 2.

|--|

Economy sector	GHG emission (%)
Electricity and heat production	25
Agriculture (crop, livestock & fishery production), forestry and other land use	24
Industry	21
Transportation	14

Venue: UGC-HRDC Hall, Kumaun University, Nainital, UK, India on dated 1-2 December, 2019

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Energy sector other than electricity or heat production, such as fuel extraction, refining,	10
processing, and transportation	
Buildings	6

Greenhouse gas emission in Indian agriculture is shown in Table 3. Among South Asian countries, India is the major producer of CO₂ (from all possible sources), followed by Pakistan and Bangladesh.

Table 3: Greenhouse gas emission (million ton) from agriculture sector in India during 2007 (INCCA, 2010)				
Source	CH_4	N_2O	$CO_2 eq.$	
Enteric fermentation by ruminants	10.10	-	212.09	
Manure management	0.12	-	2.44	
Rice cultivation	3.37	-	84.24	
Agricultural soil	-	0.22	64.7	
Crop residue burning	0.25	0.01	8.21	
Total	13.84	0.23	371.68	

Global Climate Change Projections

The atmospheric concentrations of CO_2 and CH_4 have increased by 31 and 149% respectively above pre-industrial levels since 1750. These levels are considerably higher than at any time during the last 650,000 years. The present atmospheric concentration of CO_2 is around 405 ppm by volume, and is expected to rise to 541-970 ppm by 2100 due to ongoing burning of fossil fuels and large scale land-use changes.

In recent years, global methane levels have been hitting new highs. World enteric methane emission (EME) has increased by 54.3% from the year 1961 to 2010 @ 61.5 to 94.9×10^9 kg annually, which is projected to increase to 120×10^9 kg by 2050. Global methane emission from manure (MEM) has increased from 6.81×10^9 kg in 1961 to 11.4×10^9 kg in 2010 (an increase of 67.6%), and is projected to grow to 15×10^9 kg by 2050. The EME increase by Indian livestock has been greater than world livestock (70.6\% vs. 54.3%) between the years 1961 to 2010. In India, total EME has been projected to grow by 18.8×10^9 kg in 2050. Similarly, the annual MEM increased in India from 0.52×10^9 kg to 1.1×10^9 kg (with an annual growth rate of 1.57%) in this period, which could increase to 1.54×10^9 kg in 2050. Such changes in GHGs due to natural and anthropogenic activities have shown definite impact on earth's atmosphere. Some studies and model projections about climate change are summarized below:

a. Global temperature

Global net emissions of greenhouse gases from human activities have increased by 35% between 1990 and 2010, with 42% increase in carbon dioxide. From 1990 to 2015, the total warming effect from GHGs has increased by 37%. The warming effect associated with carbon dioxide alone increased by 30%.

Global temperatures on both land (and sea) have increased by 0.75 °C (1.4 °F) relative to the period 1860–1900. The 20th century have witnessed rise in average global temperature by about 0.6°C (1° F) over the 19th century (IPCC, 2007a), while over the past 50 years the average global temperature rise has been at the fastest rate in recorded history mainly due to human activities (IPCC 2001). All of the top 10 warmest years on record worldwide have occurred since 1998.

A warming of 1.1° C to 6.4° C (2.0° F to 11.5° F) between 1990 and 2100 is expected (IPCC, 2007a). The IPCC's 4th Assessment Report indicates that a global temperature rise of 2° C to 4.5° C is almost inevitable in the current century, if we fail to arrest the current critical rate of GHG emissions. According to IPCC's 3rd Assessment Report the average annual temperatures in South Asia could rise between 3.5° C to 5.5° C by 2100. It is estimated that mean annual temperature in South Asia shall rise by $0.5-1.2^{\circ}$ C by 2020 and by $1.56-5.44^{\circ}$ C by 2080 depending upon future development scenarios.

b. Ocean temperature

The oceans have responded more slowly than land environments to global warming. The average surface temperature of the world's oceans has shown significant increase since 1880. Last one century has seen rise in ocean temperature (to about 700 m depth) by about 0.1° C (0.18°F). Since 1979, land temperatures have increased about twice as fast as ocean temperatures (0.25°C per decade against 0.13°C per decade).

c. Melting of snow

Glaciers are very sensitive to temperature fluctuations accompanying climate change. Warmer seas also lead to melting from below of polar ice shelves, compromising their structural integrity and leading to spectacular shelf collapses. Massive glacial retreat has been estimated since Industrial Revolution of 1760. Since the early twentieth century, with few exceptions, glaciers around the world have been retreating at unprecedented rates. In fact, several ice caps, glaciers and ice shelves have disappeared altogether in this century. Many more are retreating so rapidly that they may vanish within a matter of decades.

There are several glaring examples of glacier melt due to climate change.

Gangotri glacier in India has been receding since 1780, although its retreat quickened after 1971. Over the last 25 years, Gangotri glacier has retreated more than 850 m, with a recession of 76 m from 1996 to 1999 alone (NASA Earth Observatory data).

Glaciers in North-West Himalayas have shown melting at alarming rate during the last about 450 years. Glaciers have retreated about 1 km since 1550-1850 (little ice age). The last about 50 years have observed about 19% retreat in glaciated area and 23% in glacier volume. Some glaciers are retreating @ 20-30 m/year.

Glaciers in Alaska and neighbouring Canada have thinned substantially. Over the last 40 years, thinning has been of the order of 18 to 100 m depending on the elevation of the glacier.

Many glaciers in South America's Andes at the current melting rate may disappear by 2020.

The Quelccava glacier in Peru retreated 32 times faster during the period 1983–2000 than in the 20 years from 1963 to 1983.

In the Patagonian ice fields of Argentina, glaciers have receded 1.5 km since 1990.

Climate Change Impact Projections

The effects of human induced changes to atmospheric and biospheric processes over the last century on climate patterns and life forms on the planet have become quite discernible now. The global environmental changes may be grouped into three categories (Smil, 1993):

The changing composition of the atmosphere

The loss of biodiversity and onset of a global extinction crisis, and

The declining availability of critical resources and services.

a. General impacts

The frequency of heavy precipitation shall increase but the number of rainy days shall decrease, resulting in frequency of floods and droughts in the region. The total rainfall shall increase in all months, except in December-February, when it will show decline.

Global warming and increased seasonal variability in precipitation are projected to result in accelerated recession of glaciers. The Himalayan glaciers, which are the main sources of fresh water in the region, are thinning by 0.3-1.0 m/year. Most of the glaciers in Himalayas will disappear by 2035.

Flow in snow-fed rivers would increase temporarily in short term causing flash floods, but would decline in the long term. Estimates show a reduction in river flow to the tune of 30% of its current level over the next 50 years, resulting in about 20% net decline in rice yields in India. A study from FutureWater, Utrecht University and ICIMOD suggests that despite retreating glaciers, the amount of water supplied by the Himalayan mountains will increase in the coming decades at least until 2050 (Lutz et al. 2014).

There is an increased 'glacial-lake-outburst floods' (GLOF) risk in Himalayan region. Bhutan is a hub of 2,674 glacial lakes, and extremely vulnerable to GLOF when torrents of mud risk the lives of people living at mountains of this landlocked mountainous country.

Over the past 100 years, global mean (average) sea level has been rising at an average rate of 1-2 mm/y (due to thermal expansion of water and snow melting), and the rate increased to 2.4-3.8) mm/y between 1993 and 2003. The sea level is projected to rise by 0.18-0.59 m causing coastal flooding and human displacements, shoreline erosion, and more powerful storm surges that can devastate low-lying areas. Frequency of extreme weather events, heat waves, hurricanes, cyclones etc. would increase.

Outbreak of new pests and diseases expected. Diseases like malaria, dengue fever and encephalitis, and increasing deaths expected.

Risk of loss of biodiversity (animal and plant species) would increase. One study predicts 18 to 35% extinction of certain flora and fauna by 2050.

Ocean acidification i.e. decrease in pH of sea water by 0.14-0.50 units by 2100 is expected. Coupled with rise in sea water temperature (even by 1.0° C) will affect distribution and life processes of many marine organisms including fish.

Developing countries, such as in south Asia (the current territories of Afghanistan, Bangladesh, Bhutan, Maldives, Nepal, India, Pakistan and Sri Lanka), are far more vulnerable to climate change due to high population density, agriculture being the main livelihood option which is weather dependent, lack of resources and capacities to cope against climate related hazards. The IPCC report (2007a) shows that densely populated mega deltas of the region, such as in India and Bangladesh, and islands and coastal areas such as in Sri Lanka, Maldives, India and Bangladesh are more vulnerable to global climate change.

b. Impacts on natural resources (Aggarwal et al., 2012)

Soil

The potential impacts of climate change on soil health would be in terms of the OM content, temperature regimes, hydrology and salinity etc.

OM content, which is already low in Indian soils, would decrease with global warming, and its quality may also be affected.

Crop residues under elevated CO₂ levels will have high C:N ratio, reducing their rates of decomposition and nutrient release. It may, on the other hand, improve C sequestration in soils.

Increase in soil temperature will increase N mineralization, but its availability may decrease due to increased volatilization and denitrification losses.

Change in rainfall events may increase soil erosion hazards.

Rise in sea level may lead to salt-water ingression in coastal lands, reducing their suitability for conventional agriculture.

Water

A significant increase in runoff is projected in the wet season, leading to storage problems, increased frequency and duration of floods and soil erosion etc.

Global warming is associated with increased melting and recession of glaciers. Retreading glaciers in Himalayas would have a significant impact on flow of rivers, and availability of irrigation in IGP, thereby impacting food security.

Decreased flow in rivers would increase irrigation dependency on groundwater which is already declining. Lower groundwater tables and resulting increase in energy required to pump water will make irrigation more expensive, and also scarcity of water.

c. Impacts on agriculture sector (Aggarwal et al., 2012)

Crops

Primary effects of increased CO_2 concentration include higher photosynthetic rate, increased light-use efficiency, reduction in transpiration and stomatal conductance and improved WUE. Higher temperatures, on the other hand, shorten crop duration, enhance respiration and reduce time for radiation interception. Since, elevation in CO_2 levels is accompanied by rise in temperature, the net effect of increasing CO_2 and temperature would be decline in crop yields.

Increase in ambient CO₂ to 550 ppm may lead initially to a 10-15% increase in the yields of wheat, rice, chickpea and mustard, but in long run yields are expected to decline. An estimated 10-40% crop production loss is expected by 2100.

India may lose a 4-5 Mt of wheat with every 1°C rise in temperature (Aggarwal 2008).

Rice production is projected to reduce by 2-10% in different scenarios of climate change. Rice yields, in fact, have already started showing decline during the last two decades due to gradual change in weather conditions.

Irrigated maize, sugarcane and sorghum yields are expected to decline by 7-25%. Rainfed crops may show improvement in certain regions due to increase in rainfall, but overall impact would be yield decline.

Climate change would have a profound effect on abundance and distribution of crop pests and diseases, thereby impacting crop yields.

The projected increase in drought and flood events could result in increased instability in food production and threaten livelihood security of farmers. Recent drought events of 2002 impacted about 15 Mha of rainy season crops and caused about 10% yield loss in India. Similar situation occurred during 2009.

Cold wave impacts on crops like mustard, mango, guava, papaya, brinjal, tomato and potato are likely to decrease, as the cold waves and frost events are likely to decline in future due to global warming.

Increased temperatures may moderately impact the nutritional quality of cereals and pulses and thereby nutritional security.

Quality of fruits, vegetables, tea, coffee, aromatic, and medicinal plants to be affected. Basmati varieties of rice may lose their aroma. Agricultural biodiversity is also threatened by decreased rainfall and increased temperature, sea level rise, and increased frequency and severity of drought, cyclones and floods.

Livestock

Global warming would increase water, shelter and energy requirement of livestock for meeting projected milk demand.

Heat stress is likely to increase in dairy animals, adversely affecting their reproductive performance.

Heat stress may impact forage quality, ingestion of fodder and feed, declines in physical activity, and ultimately decrease dairy milk yield. Fishery

Marine ecosystems very sensitive to even the most modest temperature change.

Increasing sea and river water temperature is likely to affect fish breeding, migration and harvests.

Coral is the most vulnerable ocean organism to temperature change. Even a slight persistent temperature rise will bleach (eject their symbiotic algae) coral reefs. Bleaching slows coral growth, makes them susceptible to disease, and can lead to large-scale reef die-off. Krill, which is an important food of penguins and seals, is other organism affected by temperature rise. Krill reproduces in significantly smaller numbers when ocean temperatures rise. It may disrupt food chain of krill eaters and in turn their predators. Warmer sea temperatures are also associated with the spread of invasive species and marine diseases.

Climate Smart Agriculture - Natural Resource Management

Sustainability of agriculture production systems under climate changing scenarios, thus, is the biggest challenge today for the survival of current and future generations. The adoption of mitigation and adaptation technologies on large scale appears the only viable option. We must shift to climate smart agriculture that is environmental friendly and ensures livelihood security. It has three basic principles:

To sustain high and sustainable farm productivity and incomes, using resource conservation technologies,

To enhance resilience of livelihoods and ecosystems, and

To minimize GHGs emission.

The objectives of climate smart agriculture are to reduce hunger and poverty, and minimize environmental degradation with prime focus on farming (crops and livestock), pastoral, forestry and fishing systems. Climate-smart agriculture is a holistic concept. It covers environmental issues, for example energy, soil and water, as well as social issues, such as gender, and socio-economic issues. Transformation to climate smart agriculture requires ecosystem approach by involving multi-stakeholder and multi-sectoral coordination and cooperation. The ecosystem approach provides a framework for the better management of ecosystem services, such as carbon storage, freshwater cycling, biodiversity protection and pollination that require larger interventions.

A close link exists between natural resource management and climate smart agriculture. The natural resource management – soil, water and biodiversity – is in fact the very foundation of climate smart agriculture. Improved natural resource management is based on strong theories and principles, and needs strong infrastructural, institutional, financial, legal and political support. It also needs support of technologies like weather forecasting, early warning systems and risk insurance. These programs must link with coordinated efforts aimed at poverty alleviation, enhancing food security and water availability, combating land degradation and reducing loss of biological diversity and ecosystem services, as well as improving adaptive capacity of the system. Continuous research and developmental efforts are required to keep pace with climatic, social and ecological changes, and to address gaps in knowledge and technology to support uptake at the local level. Further, more concerted rather than sporadic efforts are needed.

Reduction in GHGs is the main climate change mitigation strategy. Well tested practices and technologies to achieve the objectives already exist. They only need to be up-scaled and taken to the field. However, while prioritizing adaptation and mitigation strategies it is important to take into consideration the socio-economic and cultural aspects of the people, the feasibility of adoption and the consequences of alternate adaptation options in terms of changing climate scenarios. Important adaptation and mitigation strategies are are listed below. *Key mitigation and adaptation technologies and practices in agriculture and forestry (IPCC, 2007b)*

Water sector Expansion of rainwater harvesting; water storage and conservation techniques; water reuse; desalination; water-use and irrigation efficiency Agriculture sector Improved crop and grazing land management to increase soil carbon storage; restoration of cultivated peaty soils and degraded lands; improved rice cultivation; techniques and livestock and manure management to reduce CH4 emissions; improved nitrogen fertilizer application techniques to reduce N2O emissions; dedicated energy crops to replace fossil fuel use; improved energy efficiency; improvements of crop yields; adjustment of planting dates and crop variety; crop relocation; improved land management, e.g. erosion control and soil protection through tree planting Forestry sector Afforestation; reforestation;

forest management;

reduced deforestation;

harvested wood product management;

use of forestry products for bio-energy to replace fossil fuel use;

tree species improvement to increase biomass productivity and carbon sequestration;

improved remote sensing technologies for analysis of vegetation/soil carbon sequestration potential and mapping land-use change;

landfill management and monitoring

Different land-use patterns have different mitigation potential. The forest biophysical mitigation potential has been estimated to be 5,380 Mt CO₂/yr on average up until 2050 (IPCC, 2001) and agriculture provides a technical mitigation potential of 5,500 to 6,000 Mt CO₂-eq/yr by 2030 (IPCC, 2007a). The emissions caused by agriculture can be reduced by more efficiently managing the carbon and nitrogen flows. This can be induced through a change in management practices.

The main sectoral climate change adaptation options for developing countries for different sectors are shown in Table 4. These are based on the feed-back from the experts from developing countries. These include both reactive and anticipatory responses to climate change. Reactive responses are those which are implemented as a response to an already observed climate impact, whereas anticipatory responses are those that aim to reduce exposure to future risks posed by climate change.

Table 4: Adaptation measures in key vulnerable sectors for developing countries

Vulnerable sectors	Adaptation measures			
Water Resources	Protection of groundwater resources	Better use of recycled water		
	Improved management and maintenance of existing	Conservation of water catchment areas		
	water supply systems	Improved system of water management		
	Protection of water catchment areas	Water policy reform including pricing and		
	Improved water supply	irrigation policies		
	Groundwater and rainwater harvesting and	Development of flood controls and drought		
	desalination	monitoring		
Agriculture and food	Erosion control	Development of tolerant/resistant crops (to		
security	Dam construction for irrigation Changes in fertilizer	drought, salt, insect/pests)		
	use and application	Research and development		
	Introduction of new crops	Soil-water management		
	Soil fertility maintenance	Diversification and intensification of food and		
	Changes in planting and harvesting times	plantation crops		
	Switch to different cultivars	Policy measures, tax incentives/subsidies, free		
	Educational and outreach programmes on	market		
	conservation and management of soil and water	Development of early warning systems		
Human health	Public health management reform	Development of early warning system		
	Improved housing and living conditions	Better and/or improved disease/vector surveillance		
	Improved emergency response	and monitoring		
		Improvement of environmental quality		
		Changes in urban and housing design		
Terrestrial ecosystems	Improvement of management systems including	Creation of parks/reserves, protected areas and		
Coastal zones and	control of deforestation, reforestation and	biodiversity corridors		
marine ecosystems	afforestation	Identification/development of species resistant to		
	Promoting agroforestry to improve forest goods and	climate change		
	services	Better assessment of the vulnerability of		
	Development/improvement of national forest fire	ecosystems		
	management plans	Monitoring of species		
	Improvement of carbon storage in forests	Development and maintenance of seed banks		
		Including socioeconomic factors in management		
		policy		
Coastal zones and	Protection of economic infrastructure	Integrated coastal zone management		
marine ecosystems	Public awareness to enhance protection of coastal	Better coastal planning and zoning		
	and marine ecosystems	Development of legislation for coastal protection		
	Building sea walls and beach reinforcement	Research and monitoring of coasts and coastal		
	Protection and conservation of coral reefs,	ecosystems		
	mangroves, sea grass and littoral vegetation			

Conclusion

Several field observations across the globe have proved beyond doubt that climate change is no more a myth but a hard fact of modern times. It is a real threat to agriculture sector which is a livelihood security of millions of poor people, especially those who are living in developing countries. The south Asia, where agriculture is the main livelihood option of the people, is going to be the worst hit region. For the mitigation and adaptation to the impacts of climate change it is important to shift to eco-friendly climate smart agriculture, which supports efficient natural resource management to sustain agricultural productivity and livelihood security. Several technologies are known and available. They must be prioritized and executed with equitable approach at local, regional, and global levels. Public awareness is very essential. Act now, act together forgetting state and national boundaries, and act differently. References

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VALIDATION OF IPM TECHNOLOGY FOR ONION THRIPS AT JEHANABAD

WAJID HASAN KRISHI VIGYAN KENDRA, JEHANABAD, BAU, SABOUR, BIHAR, INDIA

Onion trips (Trips tabaci) causes significant yield loss and ability to transmit plant pathogens, and development of resistance to insecticides. On Farm Trials were conducted at different farmers field in District Jehanabad of Bihar during croping season 2018-2019. The Technology assessed as Technical Option 01 : Farmer practices (Acephate 20 SP @ 3 gm/lt water), Technical Option 02: Spray of Spinosad 45SC @1 ml/ 3 ltr water at 50DAT followed by spray of Fipronil 5 SC @ 1ml/2 ltr water at 65 DAS and Technical Option 03: Two spray of Azdiractin 3000ppm @ 10 ml/ltr water at 50 &65 DAS with yellow sticky trap @ 50/ha. Results revealed that the higher yield of onion (233.3 q/h), BC ration 2.67 with lowest thrips infestation (3.2%) were recoded from fields treated with Two spray of Azdiractin 3000ppm @ 10 ml/ltr water at 50 &65 DAS with Blue sticky trap @ 50/ha followed by fields treated with Spray of Spinosad 45SC @1 ml/ 3 ltr water at 50DAT followed by spray of Fipronil 5 SC @ 1ml/2 ltr water at 65 DAS, onion yield was recorded 233.3 q/ha, BC ratio 2.66 with thrips infestation of 4.1 %. The lowest yields (183.1 q/ha), highest thrips infestation (38.1%) and lowest BC ration were observed from treated plots with Farmer practices (Acephate 20 SP @ 3 gm/lt water). Therefore it can be concluded that the technology option 1& 2 treated plots produce marginally higher yield and managed thrips infestation significantly. It is recommended that ecofriendly technology (Two spray of Azdiractin 3000ppm @ 10 ml/ltr water at 50 &65 DAS with Blue sticky trap @ 50/ha) for thrips management in Onion crops.

ECO-FRIENDLY MANAGEMENT OF DISEASE COMPLEX CAUSED BY ROOT-KNOT NEMATODE AND FUSARIUM WILT FUNGUS USING PGPR, *PAENIBACILLUS* SPP.

ZAKAULLAH KHAN*, BHARAT H. GAWADE AND S.C. DUBEY

DIVISION OF PLANT QUARANTINE, ICAR-NATIONAL BUREAU OF PLANT GENETIC RESOURCES, NEW DELHI

Root-knot nematodes (RKN), *Meloidogyne* spp. are sedentary endoparasites of roots, attacking a wide range of crops worldwide. The infection starts with root penetration of second stage juveniles (J2) hatched out in soil from eggs encapsulated in egg-mass laid by females on the infected roots. Fusarium wilt fungus causes wilting of the infected plants that lead to death. Infection of roots by RKN predisposes plants to infection by soil-borne root-infecting fungi resulting in the development of disease complex. The RKN, *Meloidogyne incognita*, becomes a part of an etiological complex, often resulting in combined pathogenic potential to be far greater than the sum of damage that either of pathogens can produce individually. During the last few decades, plant disease control has been based largely on the use of chemicals. However, because of concern about the quality of the environment and food in recent years, there have been worldwide efforts for the use of eco-friendly methods, which are bio-efficacious, economical, biodegradable and environmentally safe and could be ideal candidates for use as a reliable tool to control plant diseases. The use of micro-organisms to manage plant diseases offers an attractive to the use of synthetic chemicals. Reports have suggested that *Paenibacillus polymyxa* produces many antagonistic substances and controls several soil and foliar pathogens in greenhouses and fields (Mavingui and Heulin 1994; Haggag 2007; Haggag and Timmusk 2008; Khan et al. 2008; Kim et al. 2007, 2009). The purpose of this study was to screen and evaluate antifungal and nematicidal activities of *Paenibacillus* strains and to evaluate biocontrol potential of selected strains against disease complex caused by *M. incognita* and *F. oxysporum* f. sp. lycopersici interactions.

Keywords: Disease complex, Fusarium oxysporum f. sp. lycopersici, Meloidogyne incognita, Paenibacillus, rhizobacteria.

Materials and methods: The interaction of *M. incognita* and *F. oxysporum* f. sp. lycopersici was determined under the greenhouse conditions. Three-week-old tomato seedlings were planted into pots. Each plant was inoculated with *F. oxysporum* f. sp. lycopersici and/or J2 of *M. incognita*. About 7 weeks after fungus and/or nematode inoculation, plants were carefully uprooted from pots and will severity was graded using a 0–5 scale. *In vitro* experiments were conducted to screen 40 strains of *P. polymyxa* and *P. lentimorbus* for their antifungal and nematicidal activity against *F. oxysporum* f. sp. Lycopersici and *Meloidogyne incognita*, respectively. As *in vitro* assays indicated that among the tested strains, *P. polymyxa* GBR-462, GBR-508 and *P. lentimorbus* GBR-158 had the highest inhibitory activity against *F. oxysporum* f. sp. lycopersici and *M. incognita*, these strains were used for biocontrol of disease complex caused by *F. oxysporum* f. sp. lycopersici and *M. incognita* on tomato plants in potted soil. The culture of these strains grown in BHI broth for 2 days were added to potting soil around the plant roots at the rate of 5 ml per pot (10^8 CFU ml⁻¹) separately to determine their biocontrol efficacies. Plants grown in untreated soil served as control.

Results and discussion: The synergistic effect of *M. incognita* was confirmed in fusarium wilts of tomato caused by *Fusaium oxysporum* f. sp. lycopersici by comparing disease severity (wilting and plant death) between single and concomitant inoculation of nematode and fungal pathogens. In in vitro experiments, among 40 tested strains of Paenibacillus spp., 11 strains showed antifungal and nematicidal activities against F. oxysporum f. sp. lycopersici and M. incognita, respectively. Among them three strains, Paenibacillus polymyxa GBR-462; GBR-508 and P. lentimorbus GBR-158 showed the strongest antifungal and nematicidal activities. These three strains used in pot experiment to evaluate their biocontrol potential. Wilt severity of Fusarium wilt-root-knot nematode disease complex in the pot experiments were significantly reduced by the treatments of P. polymyxa GBR-508, GBR-462 and P. lentimorbus GBR-158, of which the control effects were estimated as 90-98%, and also reduced root-gall formation by 64-88% compared to the untreated control. Shoot and root growths of tomato plants were reduced significantly ($P \le 0.05$) by the infection of both pathogens; however, treatments of these bacterial strains enhanced plant growths, especially showing more shoot growth than uninoculated healthy plants. Bacterial antibiotics and other compounds present in cultural metabolites might be responsible for J2 mortality and inhibition of egg hatch and fungal growth. Paenibacillus strains produce antimicrobial substances active against fungi, bacteria and nematodes (Kajimura and Kaneda 1996; Von der Weid et al. 2003; Son et al. 2007, 2009). The pot experiments indicated that addition of Paenibacillus strains into potted soil suppressed the Fusarium wilt severity and root galling on tomato and increased plant growth. The reduction of the disease complex may be attributed to direct effects of metabolites that inhibit hyphal growth and egg hatch and induce mortality in J2, or that may have also enhanced host defense mechanism in roots that reduces invasion and consequent infection by pathogens and inhibition of giant cell formation.

Conclusion: The studies revealed that the tested strains of *Paenibacillus* species had no adverse effect on plants but promoted their growth. Thus, the protective and nutritional properties of *Paenibacillus* strains make them as environmentally friendly useful tool to reduce deleterious impact of disease complex caused by root-knot nematode and fusarium wilt on plant growth, especially in organic farming system, where plant nutrition and disease control are the main limiting factor.

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DRY-DIRECT SEEDED RICE, ZERO-TILLAGE WHEAT AND CROP RESIDUE MANAGEMENT FOR MITIGATING GLOBAL WARMING AND ENABLING SUSTAINABLE INTENSIFICATION IN RICE-WHEAT CROPPING SYSTEMS OF INDIA

ASHOK KUMAR¹*, DHARAM BIR YADAV¹, R.K. MALIK³, VIRENDER KUMAR², SUDHANSHU SINGH², PARDEEP SAGWAL², N.K. BANIK², ANURAG AJAY³, DHINU YADAV¹ AND BIDHAN MAHAPATRA² ¹CCS HARYANA AGRICULTURAL UNIVERSITY, HISAR, INDIA

²INTERNATIONAL RICE RESEARCH INSTITUTE, INDIA

³CIMMYT, INDIA

In Asia, rice is grown over 143 mha (FAOSTAT, 2017), including 44 mha in India that produced 106.7 mt grain in 2016, of which 91.5mt was *kharif* rice (GOI, 2016). Rice is the staple food of 65 % of the Indian population and every year about 2.5 million tonnes of milled rice is required to sustain present level of food adequacy/security. In India, rice contributes 43 per cent of total food grain production and 46 per cent of total cereal production. Whereas, the figures for wheat in 2014-2015 were 30.97 mha area, 86.53 mt production and 2794 kg ha⁻¹ productivity (INDIASTAT, 2016). The stagnating productivity of rice-wheat cropping systems and the depletion of natural resources in NW India over the past decade (Ladha *et al.*, 2003; Pathak *et al.*, 2003; Rodell *et al.*, 2009) has driven the country to put extra effort into increasing the productivity, and profitability of this key cropping system. Growers must sustainably produce more food at less cost, improve water and labor productivity, and reverse the trend of natural resource degradation including residue burning.

The green revolution is one of the most striking success stories of post-independence India, in which semi-dwarf varieties and their responses to external inputs (irrigation, fertilizers and pesticides) produced meaningful advances in agriculture productivity even without using the extra land. However, the green revolution impact has slowed down sharply or even reversed due to lowering of water table, micronutrient depletion, mono-culture, reducing bio-diversity and buildup of insect, diseases and weeds, development of resistance against pesticides and high concentration of pesticides or fertilizer-derived nitrates and nitrites in water courses and massive residue burning. The sustainability of the rice-wheat cropping system in India is in question, particularly in the northwest, due to reduction in the organic matter content of soil, depletion of water resources and deteriorating water quality (including ground water reservoirs), burning of residue (predominantly in Punjab, Harvana and Uttar Pradesh), reduced productivity, unsatisfactory product quality, herbicide resistance in Phalaris minor, and environmental pollution. The amelioration of above factors adds to the cost of cultivation and therefore, a decline in the total factor productivity. Declining productivity, resource constraints (land, labor, water, and energy), and climatic vulnerability necessitate sustainable intensification of the rice-wheat cropping system, to produce more with less resources while maintaining soil health and environmental quality. It necessitates to maintain natural resources most sustainably through conservation agriculture (CA) based resource conservation technologies (RCTs) such as dry-direct seeded rice (DSR), laser land leveling (LLL) and zero-tillage wheat (ZTW) through sustainable intensification and viable crop residues management (CRM). This is important because the livelihood of more than a billion agricultural populations in developing countries will depend on such technologies that raise outputs per labour-hour and per unit area at less cost (Lipton, 2004). A paradigm shift is needed to employ farmers' participatory research approach to enable sustainable intensification and curb residue burning.

Country produces roughly 628 mt of crop residue annually, 58 % of which comes from cereals and rice-wheat are the two main players. Due to one or other reasons/limitations, 40, 22 and 20 % crop residue of rice, wheat and sugarcane, respectively is being burnt. Crop residue burning causes soil degradation and severe air pollution with very bad effects on human and animal health. It has been estimated that one tone of straw on burning releases 3 kg particulate matter, 60 kg CO, 1460 kg CO₂, 199 kg ash and 2 kg SO₂ besides that resulting into almost complete loss of nitrogen while about 25, 20 and 60 % loss of phosphorous, potassium and sulphur, respectively. Therefore, it also warrants for preferably a viable and cost effective *in-situ* management of crop residues majorly through ZT and by enforcing other necessary laws, and policy framework and interventions. Severe nutrient mining particularly in rice-wheat cropping systems (RWCS) also requires immediate attention for integrated nutrient management to maintain or increase organic carbon content in soils, improve the soil fertility and arrest further mining of nutrients. This can be achieved through direct savings (cost of cultivation) or indirect savings (through improving soil health) by accelerated adoption and scaling up of relevant RCTs in different agro-ecologies of India.

Reducing non-beneficial evaporation losses in the field will lead to water saving. Changing to non-ponding/unpuddled rice cultures (DSR) may help solve such problems. The transplanting of rice under unpuddled conditions or under zero-tillage can be an alternative for improving water productivity in the medium soils. Zero-tillage has enabled farmers to sow their wheat crop immediately after rice harvesting and without any pre-sowing irrigation in some cases. The water saving under zero-tillage has been recorded at the time of first post-sowing irrigation (Malik *et al.*, 2004). Besides ZT and DSR, Laser land leveling(LLL) is also an important component of resource conservation technologies that can further improve water productivity at field level (Gupta, 2003) and it is pre-requisite to harness full benefits of other RCTs(DSR, MTR, ZT, FIRBS etc.).

Productivity gains in the Indo-Gangetic Plains (IGP) have slowed down and there is an urgent need for technologies that can prevent any further reduction in the rate of yield decline (Joshi *et al.*, 2003). *Phalaris minor*, a dreaded weed, in wheat which evolved herbicide resistance against isoproturon during 1990's in NW India led to introduction of new but costly (5 time more than isoproturon) herbicides (clodinafop, fenoxaprop, sulfosulfuron during 1997-98 and pinoxaden later on); and then zero-tillage basically to cut cost of production and this way to manage the purchase of alternate herbicides (Malik *et al.*, 2002). Now this weed has again developed multiple herbicide resistance and has become again very serious threat to wheat production. And therefore, importance and relevance of zero-tillage or Happy/Turbo seeder has been realized once again because the infestation of *Phalaris minor* is significantly reduced under zero-tillage wheat (ZTW) with or without residue as compared to CTW resulting into higher wheat yields.

Timely establishment of crops and intensifying the cropping system have been realized essential to harness higher productivity as wheat is very sensitive to late planting. In eastern IGP (E-IGP), if timely planting of wheat is not achieved, yield potential can be declined by up to 50% with significant decline in resource use efficiency because late planted wheat is more affected by terminal heat stress during grain filling period(CSISA Project's Annual Report, 2014). ZT in wheat reduces turnaround time between rice harvest and planting of succeeding wheat crop, which facilitates early wheat planting. In addition, system-based adjustments are needed to bring wheat planting early which include transition from puddled transplanting rice (PTR) to alternate crop establishment (CE) methods which does not require much water for land preparation and can be planted early with onset of pre-monsoon showers such as dry direct seeding of rice (DSR) and

mechanical transplanted rice in non-puddlled conditions (MTNPR). Time management could further be customized by integrating with short to medium duration hybrids/varieties and mechanical harvesting and threshing; all these practices facilitate in vacating the fields early for wheat sowing. With this arrangement, wheat productivity can be further enhanced by including long-duration varieties and/or by infusing some short duration mung bean variety or cover crops (*Sesbania*, cowpea, mung bean) between wheat harvest and rice transplanting to raise system productivity. Efforts must also be continued for diversification within the existing RWCS and to further intensify it with new and very potential cropping arrangements like Hybrid/short duration rice-long duration wheat(200% cropping intensity), Hybrid/short duration rice -mustard-mung bean or Hybrid/short duration rice-maize(300% cropping intensity) particularly in E-IGP. Zero tillage when practiced in conjunction with crop residue and cover crops will improve soil structure and enhance soil organic carbon (Dick *et al.*, 1998). If a farmer follows zero tillage along with residue cover and cover crops, it is easy to track carbon due to increase in soil organic carbon content (Dick *et.al.* 1998), decrease in CO₂ emissions caused by frequent tillage and reduction in fuel consumption. Displacement of PTR with DSR would also be an eco-friendly preposition in terms of reducing methane (CH₄) gas emission, reduce environmental pollution and ultimately will serve as an effective tool to mitigate the impacts of global warming.

In context of identified knowledge or implementation gaps as above, we hypothesize that sequencing of DSR and MTR in CT/ZT situations with ZT wheat could be more productive, profitable and sustainable to replace PTR-CTW/ZTW, which are already adopted at large scale. Residue retention in ZT rice in sequence with ZT wheat might simplify the complex problem of weeds to some extent besides improving system based water and crop productivity. Rotating DSR with puddled rice could help in managing more troublesome weeds (aerobic weeds, wild rice and volunteer rice) along with harnessing the benefits of DSR. Information generated based on our medium-term study in respect of weed infestation and diversity, system productivity, labor and irrigation water input in rice-wheat will further strengthen the understanding to choose viable methods for wider acceptance in a sustainable manner.

Long-term (20-23 years) impact studies on ZT continued in different cropping systems (rice-wheat, sorghum-wheat and pearl millet(20 years)/mung bean-wheat(two years) in Haryana have clearly demonstrated the multi-facial benefits of zero-tillage in wheat not only in terms of enhanced productivity and profitability but also improved soil health (more organic carbon, less bulk density, enhanced infiltration, more nutrients), improved grain quality and enhanced population of microbes besides favorable insect-pests and nematodes(unpublished data) without causing any harmful effects of serious concern so far and so on. The nutrient availability, organic matter accumulation, viable count of microbes, nutrient release pattern and functional diversity of microorganisms was relatively higher at surface layer under log-term zero-tillage across pearl millet-wheat, rice-wheat, mung bean- wheat and cotton-wheat cropping systems in Haryana(Dhinu Yadav,2019).

We also continued an investigation for six years (2010-2015) in the rice-wheat cropping system of Haryana, India, where different crop establishment methods in rice were followed by zero-till (ZT) wheat. Infestation by weeds, in general, was more under direct-seeded rice (DSR) than puddled transplanted rice (PTR). Similarly, avoidance of puddling in rice resulted in more infestation of *Phalaris minor* in wheat. Grain yield of rice under non-puddled DSR (with and without residues) was similar to conventional PTR. The grain yield of ZT wheat (5.03-6.55 t ha⁻¹) following non-puddled or ZT rice establishment was higher than that obtained in sequence of puddled systems (4.71-5.98 t ha⁻¹). Net returns from DSR/MTR based systems were also invariably higher than PTR. Water consumption was reduced by 17.0-25.7% under ZT-DSR, and 3.9-30.5% under non-puddled DSR, as compared to PTR. The results of this study indicated that the profitability and sustainability of non-puddled and ZT methods of rice establishment were better than PTR in the long-term, and also ZTW in sequence of DSR yielded higher (1-3 q/ha) than that obtained in sequence with PTR. Kumar et al. (2008) also demonstrated an 8% reduction in wheat yield when sown after puddled transplanted rice (PTR) compared with wheat sown after direct-seeded rice (DSR) in non-puddled conditions. Also, high labor demand at transplanting time, together with rising labor scarcity and increased wages, is compelling farmers to shift towards labor efficient methods (Kumar and Ladha, 2011). Dry seeded rice (DSR) is a feasible alternative to traditional manual transplanting, with reduced input costs including less irrigation water (Dawe, 2005; Humphreys et al., 2005). The labor requirement of direct seeding is about 34% that of transplanted rice (Ho Nai Kin and Romli, 2002). Balasubramanian and Hill (2000) have reported that direct seeding offers higher tolerance to water deficit and higher profit in areas with an assured water supply. DSR production systems save 11-18% water in irrigations (Tabbal et al., 2002) and reduce total labor requirement (11-66%) compared to PTR, depending on season, location, and type of DSR (Kumar et al., 2009; Rashid et al., 2009). Other benefits of DSR are easier planting, improved soil health, higher tolerance to water deficit, reduced methane emission, and often higher profit in areas with an assured water supply (Datta, 1986; Pathak et al., 2009; Kumar and Ladha, 2011). Intercultural (mechanical or manual weeding) and other mid-season operations due to line sowing become much easier in DSR than PTR. In addition, DSR matures 7-10 days earlier than PTR, allowing timely planting of the succeeding wheat crop (Giri, 1998; Singh et al., 2006).

However, weed management is the major challenge in DSR (Rao *et al.*, 2007; Singh *et al.*, 2007). In DSR, some weeds emerge simultaneously with crop seedlings and grow more quickly in moist soil than in PTR (Khaliq and Matloob, 2011), resulting in severe competition for resources with the crop. Therefore, weeds present the main biological constraint to the success of DSR (Chauhan, 2012), and failure to control weeds will result in yield losses ranging from 50 to 90% (Chauhan and Opeña, 2012). However, a range of pre- and post-emergence herbicides, to be used alone or in combination, are currently available for effective weed management in DSR (Kumar *et al.*, 2014; Yadav *et al.*, 2011, 2014, 2015 & 2016). There is a need to educate growers and extension agencies to use these herbicide(s) wisely and in a step-wise manner as per target weed(s) infesting the crop. Stale bed technique and LLL have also been realized very effective tools to reduce the pressure of weeds before sowing of rice crop. Research work on developing anaerobic rice varieties with added advantage of germination from deeper depths will allow for deeper sowing and water stagnation will further facilitate effective weed management in DSR. Similarly, herbicide tolerant rice varieties are in research pipeline which will facilitate blanket spray of designated herbicide to selectively control complex weed flora very effectively.

Machine transplanting of rice (MTR) in non-puddled soil is less labor intensive and less water demanding, and could be another alternative to PTR (Malik *et al.*, 2011; Kamboj *et al.*, 2013). Additionally, zero-tillage (ZT) in wheat can help reduce the turnaround time between rice harvest and planting of the successive wheat crop. The multi-fold benefits of zero-tillage (ZT) in wheat in sequence with rice are already well documented (Laxmi *et al.*, 2003; Yadav *et al.*, 2002; Yadav *et al.*, 2005; Yadav and Malik, 2005). Malik *et al.* (2014, 2015) have outlined long-term benefits and impacts of ZT wheat followed by different crop establishment methods in the rice-wheat system. However, despite the multiple benefits of these crop establishment methods in rice and wheat, we are yet to achieve broad scale. In this context, evidence based on long-term studies could help to eliminate some of the uncertainties.

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To conclude, focused research and extension efforts are needed to address the emerging issues of resource constraints (land, labor, water, and energy), which have emerged as major threats to the sustainability of cereal-based cropping systems in South Asia. In India, the mindset of farmers is fast switching from traditional, tillage intensive and resource inefficient crop establishment methods (PTR/CTW), to alternate resource conserving crop establishment methods (DSR/MTR/ZTW). In this context, our present medium-term and long-term system-based studies enable us to draw important inferences regarding the impact of alternate planting methods on the productivity, profitability and sustainability of rice-wheat system. ZT in wheat was reaffirmed to address many ongoing concerns with respect to weed dynamics, improved productivity and profitability besides soil health and environmental safety. In rice also, yield was maintained or improved simply by switching from PTR to DSR/MTR in ZT/CT soil conditions besides attaining higher system productivity. These alternative establishment methods also significantly reduced the cost of cultivation resulting into higher profitability. Also, there was significant saving in labor and reduction in irrigation water input in DSR/MTR under CT/ZT situations compared to PTR, and these are some of the important keys to address long-term sustainability of rice-wheat cropping system. However, the weed flora changed rapidly, becoming very complex in rice and also in wheat to some extent, once rice cultivation was switched over from PTR to ZT/CT methods. Therefore, very effective integrated weed management strategies (including herbicides and manual/mechanical methods), are pre-requisites for the success of non-puddled rice particularly in ecologies where exacerbated weed problems could jeopardize its long-term sustainability. Other option would be to retain residues in ZT systems and rotate DSR with PTR to reverse the shift in weed flora (only, if need be) along with harnessing the benefits of DSR in rice-wheat system; however, further research is required to optimize the scheduling of such rotation. These findings will help bridge up some of the existing knowledge/technical/adoption gaps and further change the mindset of researchers, policy makers and farmers for wider adoption of alternate planting methods at scale. Current scenario of herbicide resistance in *P. minor* in wheat and rice residue burning seriously warrant for immediate and comprehensive policy interventions to sustain RWCS, protect environment from pollution, reduce cost of production and mitigate global warming effects across different ecologies in near future in India.

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INNOVATIONS IN AGRICULTUAL EDUCATION -AN EDUCATIONAL TECHNOLGY PERSPECTIVE

BIRENDRA KUMAR¹ AND DIPANKAR SAIKIA² ¹SCHOLAR-IN-RESIDENCE, DEPARTMENT OF EXTENSION EDUCATION, DRPCAU, PUSA, SAMASTIPUR, BIHAR, INDIA

²DEPARTMENT OF EXTENSION EDUCATION, DRPCAU, PUSA, SAMASTIPUR, BIHAR, INDIA

Educational systems are dynamic in nature, continuously adapting to meet the emerging needs of society. India has developed strong agricultural education system since independence. The establishment of State Agricultural Universities contributed to reorganization and strengthening agricultural education system in the country. The human resource developed in agriculture education system has been instrumental in agricultural transformation in the country. However, the agricultural education system has not kept pace with the rapid technological development-taking place globally. The future strategy for agriculture is going to be very different in view of depleting land resources, depleting genetic diversity, over exploitation of natural resources, increased population, increased demand for food and other commodities and lesser chance of employment. Education has acquired a new dimension with phenomenal breakthrough in information and communication technologies. The question before us is how to improve our agricultural education and quality of graduates. It is here that science of educational technologies comes in picture to analyze the process of education and solve the problems of teaching and learning. This call for experimentation with methods of teaching for enhanced quality. The emergence of virtual classroom, open learning systems and distance education has given a new perspective to teaching and learning process. Infrastructure, knowledge and Skills in this highly specialized area is not available in the country. Scattered efforts are being made to initiate distance education, on-line learning and use of internet for agricultural education, but not much infrastructure and expertise is available within the National Agricultural Research system. Thus this calls for urgent attention of educators. This papers aims to discuss about the innovations in educational technology to improve the quality of agricultural education.

Key words: Agricultural Education, Instructional Systems, Information, ICTs

India has developed strong agricultural education system since independence. The establishment of State Agricultural Universities contributed to reorganization and strengthening agricultural education system in the country. The human resource developed in agriculture education system has been instrumental in agricultural transformation in the country. However, the agricultural education system has not been kept pace with the rapid technological development-taking place globally. In the present era of specialization and development in modern science, it is necessary that we restructure our agricultural education in a manner that the graduates coming out are job providers rather than job seekers. The future strategy for agriculture is going to be very different in view of depleting land resources, depleting genetic diversity, over exploitation of natural resources, increased population, increased demand for food and other commodities and lesser chance of employment. The question before us is how to improve our agricultural education and quality of graduates. Educational systems are dynamic in nature, continuously adapting to meet the emerging needs of society. In the era of WTO it is very much necessary to improve the quality of teaching for professional development of teachers as well as students. Education has acquired a new dimension with phenomenal breakthrough in information and communication technologies. The emergence of virtual classroom, open learning systems and distance education has given a new perspective to teaching and learning process. Education during the contemporary times is not confined to classroom teaching alone but it has become life long process according to the needs of the learners. The paper aims to discuss integration of innovations arising out of the science of educational technology to bring transformation of agricultural education so much needed now.

The country has developed strong agricultural education system over a period of nearly four decades and a half. The establishment of State Agricultural Universities on the pattern of Land Grant Colleges/Universities of the United States contributed to reorganization and strengthening of agricultural education system in country. This has certainly helped in ushering the country from the era of food scarcity to food surplus. A rapid stride made in Agriculture, during last part of the century was significantly contributed by the development of effective human resource in agriculture. Scenario of agriculture has changed; dimensions of problems are different, than what was before a decade or two. The human resources developed through agricultural education system have been instrumental in agricultural transformation in the country. A large network of agricultural education system consisting of 38 State Agricultural Universities, 4 Deemed-to-be Universities, 4 Central Universities with faculties of agriculture and 3 Central agricultural Universities has contributed substantially to give a scientific base to Indian agriculture. The challenges facing Indian agricultural education are different than before.

With the liberalization of economy, a number of multi-national companies with high tech agriculture are entering into agriculture and the competitiveness is increasing. The question before us is how to improve our agricultural education and make our graduates competitive nationally and internationally. There has been widespread consensus that quality of graduates in various disciplines of agricultural sciences does not match with the changing needs. With emerging job market scenario in front, introduction of subjects and methods of teaching and learning aligned fully with employability should form the core of the strategy for agricultural education. Employment opportunities in the off-farm sector are expected to increase at a faster rate than in agriculture. This will further emphasize the present employment shift of agricultural education curricula need to be redirected to more specifically address national problems. This reorientation should incorporate both the new role of market-oriented agriculture as well as issues of direct relevance to the improvement of subsistence agriculture and rural poverty.

Indian Council of Agricultural research has introduced many changes to revamp education system in general by introducing various components such as educational technology human Resources development, modifications of under-graduate and post-graduate curriculum, uniform pattern of curriculum & grading, computer facilities, upgraded laboratories, etc. In the era of WTO, it is necessary to improve the quality of teaching for professional development of teachers as well as students.

Education technology has evolved out of education to study the problems of education systematically through use of theoretical concepts from physical, social, behavioural sciences and technologies It is here that science of educational technologies comes in picture to analyze the process of education and solve the problems of teaching and learning this call for experimentation with methods of teaching for enhanced quality and professionalism. Advances in educational technologies must now be used to systematically design, implement and

evaluate educational process. Thus, it is necessary that programmes are run to improve quality of teaching sooner than later. Thus the following components need our immediate attention:

Human Resource Forecasting

The rising unemployment in agriculture science is sure sign of lack of proper planning and development. The rising number of state agricultural universities and private colleges indicate mismatch between demand and supply. While there is definite need to restrict admissions to under-graduate and post-graduate courses to a limit, the sub-standard private colleges must be closed. Assessment of human resource requirement in agriculture and forecasting of demands in particular fields is another need of the time. To change over to an effective market driven academic system, it is essential to predict changes in the job market. This calls for active involvement of user groups in planning and management of educational programmes.

Designing and Development of Courses

With emerging new job market in front, it is now felt that innovative courses and methods of teaching need to be formulated sooner than later. Practical job-oriented, competency based courses in organic farming, intellectual Property Right, national trade and export, natural resource management, rural communication, NGO management, Post-harvest technology, bio-diversity conservation, agricultural heritage, Designing competency based courses needs training in the craft which is scarcely available in the countries. Apart from the content, teaching methodology and evaluation procedures need to be specified to achieve the goal of competency based courses areas. This is an area calling for advanced training.

Improving Instructional System

Academic improvements do not come by wishes. It takes time, efforts and organizational commitment to improve performance in class rooms. Various stakeholders need to agree on certain norms and procedures for standardizing teaching. Accordingly standards of performance have to be assessed. No doubt, teaching has been given a place of pride in State Agricultural Universities. New teachers definitely need orientation to the standards of appropriate teaching behaviour for which there is little or no preparation prior to joining the University. Thus, most people learn by trial and imitation rather than conscious experimentation and learning. Even though, it is generally believed that the agricultural universities are paying equal importance to teaching, research and extension, teaching is less systematic and lesser emphasized in most places. All said there is little corporate planning, supervision and evaluation of teaching in agricultural universities. Once the courses are decided at the department level, it is assumed that everyone will take care of it. There is no system of monitoring if things go as planned. As a result, teaching is most easy, comfortable and stress free. Internal system of examination has placed lot of liberty on the teachers. Thus, it is not known to what extent the liberty is being used for right cause. Ultimately teachers are promoted and selected for their achievements in research rather than teaching. The reason being, there is no criteria to provide valid evidence for effective teaching. How can we prescribe standards of work performance and their effective evaluation is question of questions.

Use of Information and Communication Technologies (ICTs)

With advances in information and communication technologies, most traditional methods and media of teaching have become obsolete.Infrastucture, knowledge and Skills in this highly specialized area is not available in the country. Scattered efforts are being made to initiate distance education, on-line learning and use of internet for agricultural education, but not much infrastructure and expertise is available within the Nation Agricultural Research system. Thus this calls for special attention

Action Learning

There is an ongoing revolution in the field of teaching and learning especially in the professional fields to the extent that classroom teaching is becoming obsolete in many professional universities of the world. This calls for innovations. No doubt, classroom teaching has served its purpose in the past but preparing graduates to diagnose, solve problems and adjust with different types of work conditions calls for use of innovative methods hitherto used in others, action learning alone can expose them to the intricacies of interrelated problems in the field. Hand on training is needed for there should be continuous opportunity to apply and test skills.

Centre for Instructional Resources

Each SAU needs centre for in In-house training of teachers in teaching skills. Beginning with new teachers, the emphasis would be to impart skills of effective teaching and disseminate best teaching practices to all the teachers. Besides, support would be provided to teachers in preparing teaching packages in digital form for standardizing teaching practices, providing help and guidance in preparation of portfolio of interested teachers, formation of quality circle and conducting action research. Facility for video recording of teaching to interested teachers and preparations of literature for quality teaching can be made available there.

Partnership with Other Institutions

Not all the SAUs are endowed with vast infrastructure to provide practical education of relevance to the job market. This means that liaison needs to be created with the government and private organizations to forge working relationship for meaningful association. Electronic net working between SAUs, ICAR institutes, National Research Centers, Private and Non-Governmental Organization is called for to make agricultural education useful. Regular interaction with the private and industrial houses as well as the government organizations can help academics keep in touch with the changes and include them in the teaching process. Frequent interface with the employers and other stakeholders can sensitize both the parties and make education relevant. This calls for organizational linkages and networking. The necessity for better and closer links between education and employment in order to meet the actual needs of the region or the country through an adaptation of curricula and teaching methods to meet these needs.

Interlinking with Various National and International Originations

India has been regarded as a world teacher in the field of information technology. Not only developing country but also developed countries have acknowledged the supremacy of India in this field. Now it has become imperative for us to draw maximum benefit from it. We can make this technology to cater the needs of Indian agriculture. We can do this by linking agricultural Universities with International or Multilateral agencies engaged in serving higher education in agriculture either directly or tangentially. There are number of organizations such as United nations Educational Scientific and Cultural Organization (UNESCO) which focuses on education in developing nations but doesnot concentrate on agriculture education, the Food And Agricultural Organization (FAO) focuses on agriculture including agriculture education but primarily in developing nations, the Organization for Economic cooperation and development (OECD) has an interest in higher education and agricultural knowledge system but works principally with its members in industrialized nations. But their patch up work is inadequate for supporting cooperation on a global multiregional basis inclusive of both developing and developed

countries, so such interlinking is must. Global Consortium of Higher Education and Research for agriculture (GCHERA) stands as a good example before us.

In Summing Up

Educational systems are dynamic in nature, continuously adapting to meet the emerging needs of society. In the era of WTO it is very much necessary to improve the quality of teaching for professional development of teachers as well as students. Education has acquired a new dimension with phenomenal breakthrough in information and communication technologies. The emergence of virtual classroom, open learning systems and distance education has given a new perspective to teaching and learning process. With advances in information and communication technologies, most traditional methods and media of teaching have become obsolete. Infrastructure, knowledge and Skills in this highly specialized area is not available in the country. Scattered efforts are being made to initiate distance education, on-line learning and use of internet for agricultural education, but not much infrastructure and expertise is available within the National Agricultural Research system. Thus this calls for urgent attention of educators.

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GLADIOLUS - THE FLOWER OF PROSPERITY TO DOUBLE FARMER'S INCOME MANOJ NAZIR DIRECTORATE OF AGRICULTURE, JAMMU

The gladiolus (Gladiolus grandiflorus), popularly called "queen of bulbous" belongs to the family Iridaceae and sub family Ixoideae has its elegant flower spikes which have rich variation of colors and long vase life is commercially grown for its fascinating flowers which are used as the most preferred line flowers in floral arrangements worldwide. Gladiolus is cultivated in most of the tropical and subtropical countries of the world. In India its cultivation dates back to 19th century and has attained considerable importance as cut flower in the states like West Bengal, Uttar Pradesh, Himachal Pradesh, Maharashtra, Karnataka and in some parts of Tamilnadu and Andhra Pradesh. In small scale level this crop is cultivated in some parts of Krishnagiri, Dharmapuri, Dindigul, The Nilgiris and Coimbatore districts. However, this crop can be cultivated and spread length and breadth of the country as it has good adaptability in wide range of agro-climatic conditions. Gladiolus is grown on all types of soils having good structure and drainage. It is a winter season crop but can be grown during rainy season in low rainfall areas with mild climateGladiolus cultivation under northern Indian plains, coastal areas of Tamil Nadu and Pondicherry has a potential to change the economic scenario of farmers of these areas. For generating both money as well as employment in rural areas gladiolus is such a crop suitable for establishing floriculture industry by progressive farmers and entrepreneurs and undoubtly the best bulbous flower in India. Its magnificent spikes in dazzling colours remain fresh for 10 to 22 days. Its cultivation in Jammu region has become an important sector as consumption of flowers is rising associated with economic development. Jammu division of J and K has a wide range of climates and micro climates different production system, socio economic diversity and consumer requirements. Mostly farmers belong to small and marginal category. Diversification to horticulture crops is now the major option to improve livelihood security of small farmers and improved employment opportunities. Jammu division of (J and K) and coastal plains of India is going to play a vital role in floriculture trade which will turn the economy of these states. Floriculture scenario in Jammu province of (J and K) has changed very rapidly since 2000. In 1998 - 1999, area under gladiolus cultivation in Jammu province was 0.5 hects and its reached to 2.0 hects. In 2002 and 5.0 hects in 2004 and 10.0 hects in 2007. Now every year 25 - 50 farmers take up its cultivation in Jammu region of J and K. In 1999 40,000 spikes of gladiolus were produced, from 1999 – 2002. 1, 00,000 spikes were produced. From 2002-2004. 1, 20,000 spikes were produced and from 2005-2007. 3, 00.000 spikes were produced from the plains of Jammu region (from October to April). Despite all this Jammu import 85% of gladiolus spikes and other cut flowers from rest of the country. Floriculture sector is expericing a rapid change the world over the globalization and its effect on income generation. Consumption of gladiolus spikes in northern plains of India and coastal plains is rising day by day and this trend will continue to increase because of its demand in the market and improvement in purchasing power. A gladiolus spike has a potential to change economic scenario of poor farmers.

Consumers are becoming more aware of what to buy. They are becoming professional buyers. They tend to ask for higher choices in product quality levels depending on purpose of purchase, as well for higher levels of service and a wider and deeper assortment. Now the trend has shifted from seasonal to year round production of flowers and the soil of Jammu has potential to make spikes of gladiolus available when they are most wanted (like mothers day, Valentines Day) besides marriages, birthdays and other occasions. FAo-sponsored project on green house technology for small scale farmers should be implemented in Jammu, western U.P, and Coastal plains of Tamil Nadu which will give a confidence to farmers for green house production of flowers. Government of Jammu and Kashmir, U.P and Tamil Nadu should be instrumental in setting up of floricultural units both for export and domestic markets. Cold storage facilities for flowers for export should be set up.

Why Gladiolus has become farmer's first choice

Farmers feel secure by cultivating gladiolus as the spikes fetch then a good return in comparison to other crops and can be also intercropped with vegetables like Knolkhol, radish and floricultural crop like French marigold and gerbera. The traditional flowers like Jasmine, marigold, chrysanthemum, and tuberose are the mainstay in India. With increase in importance of protected cultivation and green house technology combined with liberalized trade policies and many concessions given to entrepreneurs, many companies have ventured into growing flowers for exports. Major cut flowers grown in India are Rose, orchids, gladiolus, carnation, anthurium and gerbera. India is especially well placed to meet international demand for cut flowers which peak during winter months. Indian floriculture has recently witnessed commendable changes which have transformed it from hobbyist activity to a commercial entripses.the value of import and export is increasing every year. For generating both money as well as employment in rural areas gladiolus is such a crop suitable for establishing floriculture industry by progressive farmers and entrepreneurs and undoubtly the best bulbous flower in India. Its magnificent spikes in dazzling Colour remain fresh for 10 to 22 days. Gladiolus cultivation has a potential to change the economic scenario of farmers of this country. After extensive touring from length to breadth of India we could gather that mostly our farmers belong to small and marginal categories are struggling hard. They do not earn much from their traditional crops. Diversification to horticultural Crops is now the major option to improve livelihood security of small farmers increase employment opportunities through earning foreign exchange.

IDEOTYPE POLYHOUSE CROP BREEDING IN INDIA

D.K. SINGH

UTTARAKHAND COUNCIL OF BIOTECHNOLOGY , BIOTECH BHAVAN, PANTNAGAR U S NAGAR UTTARAKHAND-263146

India is the second largest producer of vegetables in the world; however, as per the medical council of India, the production is much less than the requirement, if balanced diet is to be provided to every individual. The blooming targeted production can be achieved by different ways, e.g., bringing additional area under vegetable crops, using hybrid seeds/good planting materials and use of improved agro-techniques. Another potential approach is perfection and promotion of protected cultivation technology. However, the protected cultivation technologies are still in its preliminary stage in India and concentrated efforts are required from all concerned agencies to bring it at par with the global standards. In view of the fragmented landholdings of the farmers need to be encouraged so that modern technologies of cultivation can be adopted for increasing productivity and profitability with quality produce. With adoption of polyhouse and micro irrigation along with water source augmentation structures, socio-economic status of small and marginal farmers can be enhanced with generation of gainful employment. Area under protected cultivation and especially low cost greenhouses can be increased manifold in periurban areas. Production of high value vegetables during off-season via-a-vis production of high value vegetable in protected structures would benefit growers due to high price of the produce in metropolitan market.

Vegetable Crop breeding and Varieties for Greenhouse:

The introduction of greenhouse/polyhouse cultivation in India has a time lag in relation to many countries. China started protected cultivation technology almost at the same time when India made its beginning. But now China, Japan and USA are the leading countries having large area under greenhouse for horticultural crops in the world and have also developed a number of tomato, cucumber and capsicum varieties through greenhouse breeding. But on the other hand India is lagging behind because of less awareness among the farmers, lack of suitable varieties and other limiting aspects like cost, structures etc.

In India the area under greenhouse cultivation of vegetable crop is 3000 hectares, which is mainly in Maharashtra, Himachal Pradesh, Uttarakhand, Karnataka and Jammu & Kashmir. The total area under greenhouse in Uttarakhand is 250 hectares (Directorate of Horticulture, Govt. of Uttarakhand 2016). Hence, there appears ample scope for increasing area under low cost polyhouse in many folds in peri-urban areas of Uttarakhand for production of high value vegetables during off season for taking advantage of high price of the available market in nearby cities. The vegetables are considered as protective food and have high potential for protected cultivation. Breeding of crops like parthenocarpic cucumber, tomato, capsicum etc. have added advantages in the polyhouse. Breeding of Parthenocarpic Cucumber at Pantnagar

Parthenocarpy is the ability to develop fruits without pollination. The inheritance of parthenocarpy in cucumber is conditioned by an incomplete dominant gene Pc. In the homozygous condition PP produces parthenocarpic fruit early, with the first developing generally by 5^{th} node. Heterozygous Pp plant produces parthenocarpic fruit later than homozygous plant and fewer in number. The homozygous recessive pp produces no parthenocarpic fruits. Trapping of pistillate flowers was effective in identifying homozygous pp plant but failed to identify heterozygous plants. This character is controlled by an incompletely dominant gene Pc. It is being explained that the inheritance of parthenocarpy is by three independent, isomeric major genes with additive action, together with a non-allelic interaction of the homozygote-heterozygote type. Indications have been found for linkages between genes that govern parthenocarpy femaleness and the spined/hairy fruit character.

Varieties

Some of the popular parthenocarpic varieties from multinational seed companies are Kalunga, Bellissma, Millagon, Discover, Marianna, Fitness, Aramon, Fidelio. 90-0048. E 1828, B 1157, Sweet success (AAs), Country Fair, Bush Crop, Space Master, Patio Pick, Bush Whopper, Bush Champion, Bush Pickler, Euro-American, Adrian, AI Rashid F1, Mustang, Bronco, Sandra, Boneva, Daleva, Padex, Fertila, Factum, Fanspot, Femfrance, Toska 70, Farbio, Corona, Sweet Slice, Radja, Bella, La Reine.

Knowing the fact that there is no such variety which is exactly suitable for polyhouse cultivation in Indian conditions. Hence, research work at G.B Pant University of Agriculture & Technology was initiated in 2002 to develop parthenocarpic cucumber varieties. After continuous efforts two varieties of cucumber were developed for the first time for commercial cultivation by public sector institute Pantnagar for commercial greenhouse cultivation.

The details of the varieties are as below:

Pant Parthenocarpic Cucumber-2

First harvesting starts after 30 days of sowing.

Plant bears only female flowers (gynoecious) i.e. 551 in number per plant.

Average fruit weight is 400-450 gm.

The average yield is 1755 q/ha.

Plant produces seedless fruits (Parthenocarpic in nature)

Pant Parthenocarpic Cucumber-3

First harvesting starts after 32 days of sowing.

Plant bears only female flowers (gynoecious) i.e. 465 in number per plant.

The single fruit weighs about is 350-400 gm.

The average yield is 1605 q/ha.

Plant produces seedless fruits (Parthenocarpic in nature).

Breeding of Green house Tomato at Pantnagar

Tomato is a very good source of income to small and marginal farmers and contributes to the nutrition of the consumers. It is a rich source of vitamins and organic acids. It is a warm season crop and thrives well in temperatures between $16-30^{\circ}$ c and is neither tolerant to frost, nor to waterlogged conditions. It is well fitted in different cropping systems which include cereals, grains, pulses and oilseeds.

The tomato flowers are normally perfect. There are four to eight flowers in each compound inflorescence. Light protective anther cone surrounding the stigma leads to self pollination. Emasculation is usually done one day prior to anthesis. At this stage the sepal's starts

getting separated and the anthers and corral begins to change from light to dark yellow colour. The stigma is fully receptive at this stage allowing for pollination even immediately after emasculation.

Tomato is high value vegetable crop for off season and main season production under polyhouse/greenhouses. The differences are observed in production and productivity in polyhouse bred tomato (350-450 tones/ha) and field bred tomato (150-200 tones) under polyhouse condition. The average productivity of open field bred variety comes around 250 q/ha whereas under polyhouse structures, it is about 800q/ha (AICVIP Annual Report 2002-2004). The seed cost of such tomato varieties is very high, i.e. between (1.50 and 2.00 lakh/kg) and the grower also faces the problem of importing the seed every time. These two factors ultimately affect the cost: benefit ratio and the interest of polyhouse tomato growers.

Many traditional varieties such as Pusa Ruby, Pusa Early Dwarf, Hisar Lalima, Punjab Chuhara, Hisar Arun, Arka Ashish, Arka Gaurav, Pant Bahar, Pant Tomato-3 etc till date are available in the market in plenty but none of them are best suited for polyhouse cultivation.

Considering the importance and high seed cost of Israeli polyhouse bred tomato varieties, breeding for polyhouse tomato was initiated for the first time at G.B.Pant University of Agriculture & Technology, Pantnagar. The important genes favoring polyhouse cultivation were also exploited. Gene 'sp' responsible for indeterminate character was utilized for the development of these varieties. By adopting appropriate selection methods and hybrid breeding procedures two varieties namely, Pant Polyhouse Bred Tomato-2 and Pant Polyhouse Bred Tomato Hybrid-1 were developed and released. The features of varieties are as under:

Pant Polyhouse Bred Tomato-2

The variety bears 5-6 fruits per cluster.

The Single fruit weighs around 100-105 gm.

The average fruit yield is 1291 q/ha.

The fruits have better storage quality because of its thick pericarp (0.9-1.0 cm)

Pant Polyhouse Bred Hybrid Tomato-1

The variety is having 7-8 fruits per cluster.

The single fruit weighs around 130-140 gm.

Its average yield is 1616 q/ha.

Because of its thick pericarp (1.0-1.25 cm), the fruits have better storage quality.

Besides these some varieties indigenous and multi-national seed companies are also available in the market. These are Rakshita, Naveen-2000, Avinash-2, Snehlata, Heem Sohna, GS-600 and V.L Tomato 4, Tropic, Dombello, Tuckcross-520

EFFECTS OF MOLECULAR AND MACROMOLECULAR CROWDING AGAINST ENVIRONMENTAL STRESSES

ASIMUL ISLAM

CENTRE FOR INTERDISCIPLINARY RESEARCH IN BASIC SCIENCES, JAMIA MILLIA ISLAMIA, JAMIA NAGAR, NEW DELHI 110025, INDIA.

Protein misfolding is a common problem and found to be associated with various neurodegenerative diseases including, Parkinson's, Alzheimer's, Creutzfeldt-Jakob, Gaucher's, cystic fibrosis and Huntington's diseases. To develop a newer strategy for therapeutic intervention, the underlying mechanism of protein folding must be understood. Most of the studies done to understand protein folding and misfolding has been carried out in dilute solutions; whereas, the situation is very different in a cell. A cell is crowded with DNA, RNA, proteins, cytoskeleton, ribosomes and other small molecules. The process that regulates the function of the protein in physiological environments occurs in the presence of congested factors. Generally, in vivo function and structural changes are studied by probing proteins in a dilute solution under in vitro conditions which is believed to be mimicking proteins in intracellular milieu. However, there are a large number of biomolecules that are accountable for the extremely crowded intracellular environment which is totally different from the dilute solutions, i.e., the idealized conditions. Such crowded environment due to the presence of macromolecules of different sizes, shapes and composition governs the level of crowding inside a cell. Thus, we investigated the effect of different sizes and shapes of molecular crowders (glucose, fructose, sucrose, raffinose, trehalose and stachiose) and macromolecular crowders (ficoll 70, polyethylene glycol, dextran 70 and dextran 40), which are polysaccharide in nature, on the thermodynamic stability, structure and functional activity of model proteins using UV-Vis, fluorescence and FTIR spectroscopy, DSC, ITC and circular dichroism techniques. We measured the extent of stabilization of proteins, their structure and activity in the presence of theses molecular and macromolecular crowders. We also measured chemical-induced denaturation of myoglobin in the presence of ficoll 70 and dextran at different pH's (acidic: 6.0, almost neutral:7.0 and basic: 8.0). Further, we studied interaction of crowding agents with proteins using isothermal titration calorimetry and molecular docking in order to delineate the mechanism of interactions.

The main observations from molecular crowding studies are as follows: (i) Thermodynamic stability of both the proteins increases with increasing the concentration of each sugar at different pH values and stabilizing effect of sugars is entropic in origin. (ii) The degree of stabilization of proteins proportionally related to degree of oligomerization (*n*) of sugars, i.e., thermodynamic stability of proteins increase with increasing the size of sugar from mono– to tetra– saccharides. (iii) Degree of stabilization of proteins increase for each sugar as we deviate from the pI of protein. (iv) Degree of stabilizations of proteins is more in the presence of eqimolar mixture of monosaccharides than the constitutive disaccharides. (v) Sugar osmolytes do not perturb the function of protein and the increases the stability of protein by sugars does not cause the rigidity of enzyme. In the presence of crowding agents, excluded volume effect increases the stability of protein with compact native structure and this compaction brings the rigidity in native conformation. These studies reported that structural contents increased in the presence of crowding agents, the low molecular osmolytes provide the increased stability to proteins without affecting their extent of unfolding as well as of their native structure. From the macromolecular crowding agents study, we also observed that polyethylene glycol 400 Da (PEG 400) induces molten globule state in cytochrome *c* at pH 7.0 and 25 °C. This PEG-induced intermediate state has: (i) native tertiary structure partially perturbed, (ii) unperturbed native secondary structure, (iii) newly exposed hydrophobic patches, and (iv) 1.58 times more hydrodynamic volume than that of the native protein.

We concluded that lysozyme and alpha lactalbumin get stabilised by molecular crowding agents by volume exclusion while myoglobin get destabilized by the due to soft interactions. PEG 400 induces molten globule in cytochrome c. At least in case of heme proteins, soft interactions dominate over the excluded-volume effect, and leads to the formation of molten globule via formation of hydrogen bonds between the heme and the crowding agents. In brief, our study shows a remarkable and significant effect of crowding on the structure of proteins, which declares that exploring the relevance of molten globule formation in crowded environment, could be a novel work.

ABSTRACT

EFFECT OF DIVERSIFICATION OF MAIZE-WHEAT CROPPING SYSTEMS FOR ENHANCED PRODUCTIVITY AND PROFITABILITY. W. A. HAMD-ALLA

DEPARTMENT OF CROP INTENSIFICATION RESEARCH, FIELD CROPS RESEARCH INSTITUTE, AGRICULTURAL RESEARCH CENTER, GIZA, EGYPT.

Cropping system cereals- legumes are important measures to sustain soil fertility and enhance crop productivity. This study evaluated different four cropping systems maize-wheat, maize+cowpea/clover (mono-cut)/wheat, maize/clover/wheat and cowpea/clover/wheat under three nitrogen fertilizer rates were 142, 214 and 285 kg/ha in sandy soil during 2013/2014 and 2014/2015 at Arab El-Awammer Research Station, Agric. Res. Center. The experiment was evaluated in a randomized complete block design arranged in a factorial experiment with four replications. The results show that the cropping system and nitrogen fertilizer rate affected significantly all traits of wheat in both seasons. Cropping system of cowpea/clover/wheat when fertilizer rates. The cropping index was increased to be 3.39 and 2.87 in the year for the two cropping systems of maize+cowpea/clover/wheat and cowpea/clover/wheat, respectively. These values are more than the traditional index of Egypt which is 1.73. The net return from the cropping system of maize+cowpea/clover/wheat was the highest when compared with the other cropping systems. Thus increasing the cropping area which increased the cropping index caused an increase in the net return.

Keywords: wheat, cropping system, nitrogen fertilizer, cropping index and net return.

HEALTHY NUTRITION AND DISEASES: PROTEOME INTONATION IN MAMMALIAN LIVER FIBROSIS DISEASE MODEL

RIAZ AHMAD

DEPARTMENT OF ZOOLOGY, ALIGARH MUSLIM UNIVERSITY, ALIGARH-202002 (U.P), INDIA

The daily food intake which is equally nutritious and balance is extremely important for healthy life. Since the world is rapidly transforming to cosmetic, more so over to the synthetic foods, the choices for livings are limited. The targeted utilization of specific nutrients and secondary phyto-products assist the adjustment of metabolic processes in many situations. However, other than the protective diet, identifying the chemical compounds of friendly nature permits their characterization and prospective use as a new drug. Chronic liver diseases including Non-alcoholic fatty liver disease (NAFLD), Alcohol-induced liver disease (ALD), hepatitis, Non-alcoholic steatohepatitis (NASH), idiosyncratic Drug-Induced liver injury (DILI) etc are the fifth most frequent cause of death in the World. Liver fibrosis, ultimately leading to liver cirrhosis is the most common and crucial stage of all chronic liver diseases. As chronic liver diseases entail multiple clinical and pathological phenotypes and several risks, pharmaceutical intervention at the stage of fibrogenesis therefore remains a major task in today's medicine. The mapping of pathways of diseases is a vigorous affair which includes conglomeration of various biomarkers, transcription factors and molecules that orchestrate the signaling and form a nexus of cascades. Recent developments in high-throughput proteomic techniques have provided leverage in the discovery of biomarkers during the etiology of various diseases. The proteomics field emphasizes on the functional aspects of the proteomic landscape. This manifests a more extensive comprehension of the biological mechanisms as proteins are closer than genes in the context of functionalities in vivo. We have worked on the proteomic aspects of the DMN/DEN- induced liver fibrosis model and have obtained data on differentially expressed protein signatures relevant to the disease. This significant approach has provided eighteen biomarkers of the disease and gives profound understanding and a framework to the researchers for future prospects in the molecular pathways of Drug Induced Liver Fibrosis (DILI) and it's mitigation by resveratrol and POM juice respectively.

Keywords: Liver fibrosis; Pomegranate juice; Proteome; Resveratrol

ECONOMIC IMPORTANCE OF ENVIRONMENTAL DEVELOPMENT OF BIOENERGY FROM AGRICULTURE RESIDUES AND ENVIRONMENT

ABDEEN MUSTAFA OMER

ENERGY RESEARCH INSTITUTE (ERI), NOTTINGHAM, UK

This communication discusses a comprehensive review of biomass energy sources, environment and sustainable development. This includes all the biomass energy technologies, energy efficiency systems, energy conservation scenarios, energy savings and other mitigation measures necessary to reduce emissions globally. The current literature is reviewed regarding the ecological, social, cultural and economic impacts of biomass technology. This study gives an overview of present and future use of biomass as an industrial feedstock for production of fuels, chemicals and other materials. However, to be truly competitive in an open market situation, higher value products are required. Results suggest that biomass technology must be encouraged, promoted, invested, implemented, and demonstrated, but especially in remote rural areas.

Keywords: Biomass resources, wastes, woodfuel, biofuels, energy, environment, sustainability related with bioenergy development, disperse systems formulation science, surfactant sciences

SCREENING AND DEVELOPING SWEET MAIZE MATERIALS FOR FRUIT MAIZE BREEDING BY PHENOTYPES AND MOLECULAR MARKERS

NGUYEN TRUNG DUC^{1*}, PHAM QUANG TUAN¹, NGUYEN THI NGUYET ANH¹, VU VAN LIET² ¹CROPS RESEARCH AND DEVELOPMENT INSTITUTE, VIETNAM NATIONAL UNIVERSITY OF AGRICULTURE ²FACULTY OF AGRONOMY, VIETNAM NATIONAL UNIVERSITY OF AGRICULTURE

Fruit maize is new type of sweet maize, which can eat directly at immature stage. The objective of this study to distinguish genetic diversity of 44 sweet maize inbred lines by phenotypes and molecular markers for hybrid fruit maize breeding suitable for eating without cooking. These inbred lines were selfing S3-4 generation from exotic germplasms introduced from Thailand, Japan and China at the Crop Research and Development Institute, Vietnam National University of Agriculture in spring season 2018. The results showed that 44 inbred

lines could be grouped into eight distinct agronomical groups with genetic similarity of 0.16. Tassel types, number of primary tassel branches, number of secondary tassel branches, degree of stem zig-zag, row straightness, and filled ear tips play vital roles for identify and grouping their sweet maize inbred lines. Brix (representative for sugar content) showed strongly significant negative correlated with 1000 grain weight (r = -0.8579). Grain yield showed positive correlated ($P \le 0.01$) with 1000 grain weight (r = 0.5861), number of kernel per row (r = 0.8788) và ear length (r = 0.5181). SSR marker (*umc2118-bmc1325*) can be used for identify pericarp thickness of sweet maize inbred lines have % Brix from 13.5 to 23.8, thickness of pericarp from 44.5µm to 81.9µm and marketable husk yield from 6.7 to 9.7 ton/ha. These lines can be used for sweet inbred lines development for hybrid fruit maize breeding program.

Keywords: fruit maize, pericarp thickness, phenotype, molecular marker

ROLE OF REMOTE SENSING AND GEOGRAPHIC INFORMATION SYSTEM IN LAND USE LAND COVER INTERPRETATION: A CASE STUDY OF EASTERN SOHAG, EGYPT.

ALI R.A. MOURSY

DIVISION OF SOIL AND WATER SCIENCES, FACULTY OF AGRICULTURE, SOHAG UNIVERSITY, EGYPT

Nowadays, there is an increasing need for accurate soil spatial data to be easily shared and used between the soil science communities. This study aimed to present the role of remote sensing and geographic information system as effective tools for land use land cover interpretation. The investigated area was a part of Eastern Sohag, Egypt with an area of 204km². Landsat7 ETM⁺ multispectral satellite image and Google earth image were used for visual interpreting of the land use land cover (LULC) of the study area. Digital elevation model was extracted from the image and generated in a map using ArcGIS-10.1 software. The area was classified depending on its elevation in six mapping units *viz*, Wad floor (61.82km²), Low elevated sand sheet (30.07km²), High elevated sand sheet (31.05km²), Bajada (27.47km²), Piedmont (27.45km²) and Table land (26.54km²). Supervised classification was done for the area of study using ENVI-5.0 software. Land used land cover interpretation was done which soil, vegetation, water bodies and built-up areas were identified easily. These results can be used as a guide for decision makers and stake holders for better planning and agricultural land management. Remote sensing (RS) and geographic information system (GIS) as promising techniques should be strongly recommended for different fields of soil studies.

Keywords: remote sensing, geographic information system, Arc-GIS, ENVI, Sohag.

ASSESSMENT OF THE ROLE OF AGRICULTURAL INNOVATION AS A LIVELIHOOD SUSTAINING STRATEGY IN CENTRAL AND WESTERN NEPAL

ROSHANI GHIMIRE¹, SAROJ PANTHI², SUSHILA BARAL^{3,} ASHIS PANDEY⁴

¹DIVISION OF ENTOMOLOGY, INDIAN AGRICULTURAL RESEARCH INSTITUTE, NEW DELHI

Increasing agriculture knowledge is gradually enhancing the agriculture production either by the improvement of the existing traditional practices or through the generation of new practices .New ideas generated in agriculture can be the core reason to sustain the livelihood of the farmers who are dependent on agriculture. But the role of agriculture innovations in day to day of life of farmers is not clearly identified. In order to identify the role of agricultural innovation as a livelihood sustaining strategy, explorative study was carried out 70 households of Chitwan, Kaski and Rupandehi district of Central and Western Nepal. Purposive selection of site with snowball sampling technique to select innovative farmers followed by simple random sampling techniques for the selection of non-innovative farmers was done by means of pre-structured and pretested questionnaire. Study revealed that innovation have higher land tenancy. Majority of the innovators were found to be literate that indicates as the level of education goes up the chances of innovation in agriculture also rises. It was found that farmers being engaged in modern farming system are more likely to practice agricultural innovation. From the study it was found majority of the innovators are facing assets related problem having self-effort of the innovators themselves as a major solution. The study showed the role of agricultural innovation in sustaining livelihood strategy is found to be optimistic considering the prevailing problems being solved.

Key words: Innovation, Livelihood, Snowball

EFFECT OF WEED CONTROL ON WEEDS, GRAIN YIELD AND ITS COMPONENTS OF MAIZE (ZEA MAYS L)

OLA ZAKARIA EL-BADRY* AND EL-SAYED GHEITH

AGRONOMY DEPARTMENT, FACULTY OF AGRICULTURE, CAIRO UNIVERSITY, EGYPT

The present study entitled "effect of weed control on weeds, grain yield and its components of maize (*Zea mays* L.) cv. Single cross-10 was carried out at the Agricultural and Experiments Research Station at Giza, Faculty of Agriculture, Cairo University, Egypt. The experiment was conducted in the summer 2017 and was repeated in 2018 on the same piece of land to conform previous findings. The experiment design was Randomized Complete Block design (RCBD) having three replications. Six treatments include atrazine (1.0 kg/ha), glyphosate (0.8 kg/ha). atrazine + glyphosate, one hand hoeing after three weeks, hand hoeing twice after three and five weeks from sowing and weedy chick as control were used. Results indicated that glyphosate was found superior to atrazine for all studied characters. Moreover, lower weed dry matter accumulation and higher weed control % as well as higher values of ear characters (ear length, ear diameter, grain weight/ear and shilling %) and grain yield per unit area were recorded in tank mix application of atrazine + glyphosate followed by hand hoeing twice.

Key words: Maize, yield, yield components and weed control.

EFFECT OF CONCENTRATIONS OF GIBBERELLIC ACID IN BREAKING DORMANCY OF DIFFERENT POTATO (SOLANUM TUBEROSUM) VARIETIES AT RASUWA, NEPAL

ADARSHA SIGDEL

AGRICULTURE AND FORESTRY UNIVERSITY, RAMPUR, NEPAL

The experiment entitled "Effect of concentrations of Gibberellic acid in breaking dormancy of different potato (*Solanum tuberosum*) varieties at Rasuwa" was conducted in Dhunche, Rasuwa, Nepal from 2nd May to 15th June,2017 . Uniform sprouting is always a challenge to achieve. To address the problem a two factorial experiment based on completely randomized block design with four replications was conducted to investigate the effect of Five hormone treatments (H1: 0.5% of ethanol + 0 mg/l of gibberellic acid, H2:0.5% of ethanol + 5 mg/l of gibberellic acid, H3: 0.5% of ethanol + 10mg/l of gibberellic acid, H4: 0.5% of ethanol + 15mg/l of gibberellic acid, H5: 0.5% of ethanol + 20 mg/l of gibberellic acid) on mini tubers of two varieties of potato (Khumal Seto-1 and MS-42,3). The longest sprouts were about 17.34mm long and they were produced by MS-42.3 variety and in case of treatment5 the highest sprout length as 10.8125mm. The highest no of sprouts were obtained in MS-42.3 6.05 at Treatment 5 and the highest no of sprouts in Khumal seto-1 was 4.75 at treatment 5. Khumal Seto-1 had the shortest dormancy duration as well as days to first emergence at lab condition. Applying H3 hormone level produce more sprouts per tuber in Khumal Seto-1. MS-42.3 was better than Khumal Seto-1with or without hormone treatment in respect of all measured traits. Higher GA concentration accelerates tuber sprouting in both varieties. Except in dormancy break and days to first emergence all parameters observed i.e. Average Sprout Length and Average Sprout Density variety MS-42.3 was found superior in accordance to gibberellic treatment.

Key words: dormancy, seed tuber, gibberellic acid.

COMPARATIVE EFFICIENCY OF DIFFERENT WEED MANAGEMENT PRACTICES ON YIELD AND ECONOMIC IN SUMMER MAIZE IN DANG

ABHISEK SHRESTHA¹, BHARTI THAPA²

TECHNICAL OFFICER, REGIONAL AGRICULTURAL RESEARCH STATION, PARWANIPUR, BARA INSTITUTE OF AGRICULTURE AND ANIMALS SCIENCE, LAMJUNG, NEPAL

The particular weed management practice is still know that describes the exact solution for weed control and maximizes the yield and profitability of maize production and weed severs to more than 40% loss in production. So, the field experiment was conducted in Farmer's field to compare the effects of different weed management practices on weed growth and dynamics, yield, and economic performance in Summer Maize under humid sub-tropical condition at Aswara-5, Tulsipur, and Dang in 2017. The experiment was conducted in Randomized Complete Block Design with seven treatments and three replications. The treatments consisted of (i) Framer practices, (ii) control, (iii) weed free broadcasting (iv) Weed free line sowing (v) power weeded (vi) Manually weeded (vii) herbicides (Temboterine and Atrazine). The different weed managements practice showed significant effect in Yield, test weight, Harvest index, stover yield, shelling percent and sterility percent and cob length. The higher grain yield was obtained in herbicide treated plot (7.620 t/ha) and least in control plot (3.54 t/ha) and farmer practice plot (4.32 t/ha) where other treatment were statistically at par with each other. The highest shelling and cob length was 78.33 and 21.76 cm found highest that leads to highest yield and lower yield in control and farmer plot. The cost of cultivation was higher in weed free line sowing (NRs 89102) and broadcasting (NRs 89106) condition but the production per unit cost was highest in herbicides (109.27 g/Rs) plot and followed by manual (69.73 g/Rs) and power weeded plot(78.11 g/Rs). Similarly, the highest Net revenue, Gross revenue and Benefit cost ratio was obtained in Herbicide treated plot among all the treatment, which is followed by power weeded plot. So, we can conclude that, herbicide treated plot is economically and profitability important in terms of production where there is human labor crisis.

Keywords: Maize, Manual, Herbicides, Weeds

REPSONSE OF WHEAT YIELD AND ITS COMPONENTS TO ZINC AND IRON APPLICATION UNDER DIFFERENT LEVELS OF NITROGEN

EL-SAYED GHEITH* AND OLA ZAKARIA EL-BADRY

AGRONOMY DEPARTMENT, FACULTY OF AGRICULTURE, CAIRO UNIVERSITY

To evaluate the effect of nitrogen, zinc and iron as soil application on yield and yield component of wheat, the present study was conducted at Agricultural and Experimental Research Station at Giza, Faculty of Agriculture Cairo University, Egypt during 2015/2016 and 2016/2017 seasons. The experimental design was split-plot in randomized complete block design with three replications. Results showed that positive significant effect on plant height, number of spike/m², spike length; number of grain per spike, grain yield per unit area in both seasons and grain protein content in one season were achieved by application of N and the micronutrients. Whoever, the highest significant in the above mentioned characters was obtained either by application the highest N levels (100kg N /fed.) or in addition to mixture of Zn and Fe. The interaction between the studied factors had significant effect on plant height and grain yield in both seasons as well as on grain protein content in the second season, where the highest values of these parameters were recorded by application of 100kg N/fed., Zn and Fe in mixture.

Key word: Wheat yield, nitrogen, zinc and iron.

INVESTIGATION ON SUITABLE WHEAT GENOTYPES FOR LATE SOWN CONDITION IN CENTRAL TERAI REGION OF NEPAL

RAJENDRA P.YADAV¹, DEEPAK PANDEY³, ABHISEK SHRESTHA¹, DINESH K. CHAUDHARY¹, KHEM R. PANT³ AND DEV N. TIWARI² ¹REGIONAL AGRICULTURAL RESEARCH STATION, PARWANIPUR, BARA, NEPAL ²NATIONAL RICE RESEARCH PROGRAM, HARDINATH, DHANUSHA, NEPAL ³NATIONAL WHEAT RESEARCH PROGRAM, BHAIRAHAWA, RUPANDEHI, NEPAL A field experiment was carried out at Regional Agricultural Research Station, Parwanipur, Bara during 2017/18 and 2018/19 to identify suitable wheat genotypes for late sown conditions. The coordinated varietal trial was laid out in Alpha Lattice design in two replications using twenty genotypes including three standard check varieties Bhrikuti, RR21 and Gautam. There was highly significant to significant differencce in grain yield, thousand grain weight and days to heading among the genotypes included in CVT trial in both the years. The result demonstrated that highest grain yield was obtained from genotype NL 1369 (2559 kg/ha), NL 1202 (2453 kg/ha) followed by genotype Gautam (check) 2023 kg/ha during 2017. Similarly, in 2018, genotype NL 1298 (3914 kg/ha) and NL 1362(3853kg/ha) produced highest grain yield followed by Gautam (check) with 3841 kg/ha. These genotypes were found bold and plump grain with thousand grain weight of BL 4868(53g), BL4818 (46g), NL 1360 (43g) and BL4708 (39g) respectively. On other hand, phonological observation reflected that the genotype NL 1326(65days), BL4708 (61 days) and Gautam (69 days) was found early heading in 2017. Similarly BL 4868(67 days), NL 1298 (67days) and Gautam (69days) was early heading in 2018. The genotypes that were found very outstanding will be further evaluated in the subsequent years and most promising genotypes in both year will considered for the varietal release process.

Keywords: Late sown, Coordinated Varietal Trial, Genotype and Yield attributing character.

OPTIMIZATION OF GROWTH AND YIELD OF *JATROPHA CURCAS* L. (PHYSIC NUT) INFLUENCED BY PRUNING LEVEL AND FERTILIZER APPLICATION.

¹SUMED R. G, ²SHAHBAZ NOORI AND ³SHIVANNA H.

¹DEPT. OF FOREST PRODUCTS AND UTILIZATION; ²DEPT. OF SILVICULTURE AND AGROFORESTRY ³DEPT. OF FOREST BIOLOCY AND THEF IMPROVEMENT. COLLECE OF FORESTRY, SIRSL (LAS, DHARW.)

³**DEPT. OF FOREST BIOLOGY AND TREE IMPROVEMENT, COLLEGE OF FORESTRY, SIRSI (UAS, DHARWAD)** Proper application of fertilizer and appropriate canopy management under different growing conditions and agronomic practices can obtain reliable yield of *Jatropa curcas* L. (Physic Nut). The objective of study was to determine the influence of pruning level in first year and fertilizer rate of combined NPK in the first and second year on growth and yield of Physic nut, conducted at Agricultural Research Station, Prabhunagar (Dharwad). The seeds were dibbled at 3 x 2m spacing apart. A split plot design with three replications was used. Four pruning levels of 100 cm, 150 cm, 200 cm and No pruning from the ground were assigned in main plots and combination of NPK fertilizers levels (40:40:40, 60:60:60, 80:80:80 N:P₂O₅:k₂O g/ plant) were arranged randomly in subplots. All pruning levels from the ground did not have significant effects on number of branches and collar diameter, whereas application of fertilizer did increase number of branches, collar diameter, fruit yield and seed yield (15.77, 18.71cm, 316.65 and 727.96 g per plant respectively). Number of branches and collar diameter of Jatropha were significantly higher in pruning at 100 cm height from ground level (16.94 and 17.04cm respectively) as compared to other pruning levels. It is thus recommended to prune Physic nut at 200 cm from the ground and apply fertilizer at the rate of (80:80:80 g H:P₂O₅:K₂O per plant) as it recorded maximum seed yield per plant (1142.95 g) and per hectare (1903.68 kg.) respectively over other treatment combinations.

Key words: Biofuel, Fruit Yield, Physic nut (Jatropha curcas L.), Pruning, Seed Yield.

STUDIES ON PONGAMIA PINNATA (L.) BASED AGROFORESTRY SYSTEM

S. S. INAMATI¹ AND GIRISH SHAHAPURMATH²

¹DEPT. OF SILVICULTURE AND AGROFORESTRY; ²DEPT. OF NATURAL RESOURCE MANAGEMENT COLLEGE OF FORESTRY, SIRSI (UAS, DHARWAD) KARNATAKA.

The present investigation was carried out in 8 year old Pongamia pinnata seed sources established at AICRP on Agroforestry, Main Agriculture Research Station, University of Agricultural Sciences, Dharwad which consists of eleven sources originated from three provenances region of Maharashtra, Tamil Nadu and Karnataka, growth performance, characterization of morphological characters, effect of sources on intercrops soybean and safflower compared with sole crops with two distances (1.5 m and 3 m) from Pongamia row. In the present study, the higher growth attributes, height, diameter at breast height, crown area and number of branches was maximum in Pongamia source RAK-89, with some fluctuations during the experiment, MTP-II also performed better and was most suitable sources for the experiment site. Seed yield of soybean was maximum in DPS-4 + soybean (723.8 kg ha⁻¹) followed by RAK-89 + soybean (676.5 kg ha⁻¹), under safflower as intercrop, seed yield of safflower was maximum in DPS-4 + safflower (436 kg ha⁻¹) followed by RAK-89 + safflower (418.63 kg ha⁻¹) as compared to other Pongamia sources. Growing of intercrops under MTP-III + soybean and MTP-I + safflower resulted in decreased yield due to lower growth and yield components. Among Pongamia sources based agroforestry system, the yield of soybean and safflower were affected more than that of sole crops. In general, the influence of Pongamia sources on the performance of soybean and safflower was severe nearer to tree base compared to farther from the tree. Yield reduction in MTP-III + soybean was 1 per cent and MTP-I + safflower was 2.5 per cent at 1.5 m distance compared to 4 m distance from tree. Net income from intercrops in agroforestry system was higher (Rs. 29,699 ha⁻¹) in MTP-I + FC followed by DPS-4 + FC (Rs. 26,411 ha⁻¹) sacrificed agriculture income was lower in DPS-4 + FC (Rs. 24,065 ha⁻¹) as compared to other Pongamia sources. Higher income was from DPS-4 + FC (Rs. 54,528 ha⁻¹) 1 yr⁻¹) and lowest income was in MTP-III + FC (Rs. 37,856 ha⁻¹ yr⁻¹). Net return was higher in sole crops than agroforestry system. BC ratio was higher in DPS-4 + FC (1.25) followed by RAK-90 + FC (1.15) and RAK-89 + FC (1.13). Nutrient concentrations in Pongamia pinnata differed significantly among Pongamia sources, RAK-89 Pongamia source observed higher uptake of nutrients, nutrient concentration were higher in leaf tissue compared to woody ones, nutrient concentration in the order N > K > P. Soil is the largest reservoir for all nutrients, nitrogen content in the soils of RAK-89 was almost 30 per cent more than MTP-III source. From the carbon sequestration point of view RAK-89 Pongamia source sequestered more organic carbon and higher CO₂ sequestered as compared to other sources under study.

TRADITIONAL PLANT SPECIES USED FOR TREAMENT OF SNAKE BITE IN KARNTAKA

HANUMANTHA. M¹., GIRISH B. SHAHAPURMATH² AND ROOPA S. PATIL³ ¹DEPARTMENT OF FOREST PRODUCTS AND UTILIZATION, COLLEGE OF FORESTRY, SIRSI, UAS, DHARWAD ²DEPARTMENT OF NATURAL RESOURCE MANAGEMENT, COLLEGE OF FORESTRY, SIRSI, UAS, DHARWAD

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³KRISHI VIGYAN KENDRA (KVK), SIRSI, UAS, DHARWAD

Since time immemorial human society has developed amidst with the plant-life. The art of herbal healing has very deep roots in Indian culture and folklore. Even today in most of the rural areas, people are depending on local traditional healing systems for their primary health care. Over 16,000 species of higher plants occur in India, of which approximately 9000 are known to be economically useful. Of these, 7500 are used for health care by various ethnic communities in India. Today 80% of the world's population depends on traditional medicine for their primary health care needs (WHO). Medicinal plants are the backbone of the traditional medicine; this means that, 3300 million people in the underdeveloped countries utilize medicinal plants on a regular basis. Snakebite, a medical emergency encountered in the tropics and estimated 35,000 to 50,000 people die of snakebite every year in India. The common poisonous snakes found in India are Cobra, Krait, Russell's viper and Saw-scaled viper. Many medicinal plants and plant based natural products have been reported to possess anti venomous properties. Certain compounds such as β -sitosterol, stigmasterol isolated from plants were found to be effective against snake venom. Application of the plant or its sap on to the bite area, chewing leaves and bark, or drinking plant extracts or decoctions helps in counteracting snake venom activity. Several scientists have been surveyed and worked on plant species used for treating snake bites in Karnataka. The important plants species widely used for treating snake bite are Acalypa indica (Leaf), Achyranthes aspera (Root Powder), Acorus calamus (Rhizome), Aegle marmelos (Root), Alstonia scholaris (Stem bark), Andrographis paniculata (Leaf powder), Aristolochia indica (Fresh roots), Barringtonia racemosa (Leaves), Calotropis gigantea (Root), Cassia fistula (Fruit powder), Cyperus rotundus (Tuber), Eclipta alba (Roots), Rauvolfia serpentina (Root and Leaf), Strychnos nux-vomica (Root paste).

Key words: Snake bite, Traditional medicine, Medicinal plants, Folklore

SCOPE FOR VALUE ADDITION OF NON TIMBER FOREST PRODUCTS (NTFPS) IN IMPROVING LIVELIHOOD OF FOREST DEPENDENT COMMUNITIES

HANUMANTHA, M¹., SHAHBAZ NOORI² AND ROOPA S. PATIL³

¹DEPARTMENT OF FOREST PRODUCTS AND UTILIZATION, COLLEGE OF FORESTRY, SIRSI, UAS, DHARWAD ²DEPARTMENT OF SILVICULTURE AND AGROFORESTRY, COLLEGE OF FORESTRY, SIRSI, UAS, DHARWAD ³KRISHI VIGYAN KENDRA (KVK), SIRSI, UAS, DHARWAD

Forests around the world provide variety of valuable products aside from the timber. The world's total forest area is just over 4 billion hectares (corresponding to 0.6 ha per capita). Around 1.2 billion hectares of forest are managed primarily for the production of wood and non-wood forest products, which is 30 percent of world's forests. Of the nearly 425 families of flowering plants in the world, 328 families with 21,000 species occur in India. From this varied emporium, Non Timber Forest Products (NTFPs) are derived from over 3,000 species. NTFPs are defined as "Non-wood forest products consist of goods of biological origin other than wood and fuel wood, derived from forests, other wooded land and trees outside forests". NTFPs are primary or supplemental source of livelihood mainly in the poor and developing nations. NTFPs contribute significantly to forest economy of developed and industrialized nations also. NTFPs can be processed or value added into consumer oriented products. They have commercial importance and can contribute to the economic development of a region or a nation. Commercialization or value addition of NTFPs is presently promoted as an approach to rural development especially in the tropical forest area. Value addition is the process of changing or transforming a product from its original state to a more valuable/usable state. By value addition we can extend the life of the product (Edible fruits; Jack, Amla, Karanda), protect the product from environmental/price fluctuations (Perishable fruits such as Garcinia, Jack), increase the value of the products (Triphala churna from Chebula, Amla, Bellarica seeds; edible products such as chips, juice, candy from edible fruits) and improve the economy of the people (Tendu leaves, Kittul fibres, Agave fibres, Sal leaves, Palas leaves, Essential oils, TBOs, Lac, Honey, Henna, Soapnut, Shikakai and Decorative seeds such as Adenanthera, Childlife tree).

Key words: Forest, NTFP, Value addition, Edible fruits

CULTURAL AND HERITAGE VALUES OF SANDALWOOD IN DIFFERENT RELIGIONS ACROSS THE WORLD GIRISH SHAHAPURMATH^{1*}, INAMATI, S. S¹., HANUMANTHA, M¹. AND SHAHBAZ NOORI² ¹COLLEGE OF FORESTRY, UASD, SIRSI-581 401, UK DISTRICT, KARNATAKA, INDIA.

²DEPARTMENT OF SILVICULTURE AND AGROFORESTRY, COLLEGE OF FORESTRY, SIRSI, KARNATAKA.

Sandalwood has held a religious significance within the Hindu and Buddhist communities for thousands of years. Sandalwood paste is integral to rituals and ceremonies, to mark religious utensils and to decorate the icons of the deities. It is also distributed to devotees, who apply it to the forehead or the neck and chest. The paste is prepared by grinding wood by hand upon granite slabs (popularly known as Saane kallu in Kannada and Ammi kallu in Tamil) shaped for the purpose. With slow addition of water a thick paste results (called Kalabham in South India), which is mixed with saffron or other such pigments to make Chandan. Chandan further mixed with herbs, perfumes, pigments and some other compounds result in Javadhu. Kalabham, Chandan and Javadhu are dried and used as Kalabham powder, Chandan powder and Javadhu powder respectively. Chandan powder is very popular in North India and is also used in Nepal. In Thirupathi (AP) after religious tonsure, Sandal paste is applied to protect the skin. Sandalwood is considered in Hinduism and Ayurveda to bring one closer to the divine. Thus, sandal is one of the most used holy elements in the Hindu and Vedic society. Sandalwood is considered to be of the padma (lotus) group and attributed to Amitabha Buddha. Sandalwood scent is believed to transform one's desires and maintain a person's alertness while in meditation. Sandalwood is also one of the more popular scents used when offering incense to the Buddha. The Gomateshwara statue is bathed and anointed with milk, water and saffron paste and sprinkled with sandalwood powder, turmeric, and vermilion during Mahamastakabhisheka for every twelve years. In sufi tradition sandalwood paste is applied on the sufi's grave by the disciples as a mark of devotion. It is practiced particularly among the Indian subcontinent sufi disciples. In some places sandalwood powder is burnt in Dargah for fragrance. In some parts of India during the Milad un Nabi in the early 19th century, the residents applied sandalwood paste on the decorated Buraq and the symbols of footprints of the Prophet Mohammed. In some places of India during the epidemic, it was common among the South Indian devotees of Abdul-Qadir Gilani (also known as pir anay pir) to prepare his imprint of a hand with sandalwood paste and parade along the bylines, which they believed would cause the epidemic to vanish and the sick to be healed. A paste of turmeric and sandalwood powder is also applied on the girl's hands and body during the Mehndi (henna) ceremony in Muslim wedding. Sandalwood, along with agarwood (Aquilaria agallocha), is the most commonly used incense material by

the Chinese and Japanese in worship and various ceremonies. Incense burning is a common Chinese religious ritual in Chinese ancestor worship, Taoism and Buddhism. Incense use in religious ritual was simultaneously developed in China, and eventually transmitted to Korea, Japan, Vietnam and the Philippines. Zoroastrians offer sandalwood twigs to the fire keeping priests who offer the sandalwood to the fire which keep the fire burning. Sandalwood is offered to all of the three grades of fire in the Fire temple, including the Atash Dadgahs. Sandalwood is not offered to the divo, a homemade lamp. Often, money is offered to the mobad (for religious expenditures) along with the sandalwood. Sandalwood is called *Sukhar* in the Zoroastrian community. The sandalwood in the fire temple is often more expensive to buy than at a Zoroastrian store. It is often a source of income for the fire temple.

Key words: Sandalwood paste, Padma, Sukhar, Mobad, Zoroastrian community, Agarwood

FOREST POLICY - A SUSTAINABLE TOOL FOR FOREST MANAGEMENT IN INDIA

GIRISH SHAHAPURMATH^{1*}, HANUMANTHA, M¹., INAMATI, S. S¹AND SHAHBAZ NOORI² ¹COLLEGE OF FORESTRY, UASD, SIRSI–581 401, UK DISTRICT, KARNATAKA, INDIA. ²DEPARTMENT OF SILVICULTURE AND AGROFORESTRY, COLLEGE OF FORESTRY, SIRSI KARNATAKA

A national forest policy is considered to be a negotiated agreement between government and stakeholders (i.e. all those who depend on or benefit from forests or who decide on, control or regulate access to these resources) on the orientations and principles of actions they adopt, in harmony with national socioeconomic and environmental policies, to guide and determine decisions on the sustainable use and conservation of forest and tree resources for the benefit of society. A national forest policy is not to be unilaterally imposed by government. Ideally, it is an agreement among bodies that represent different forest interests and is formally adopted by government. Who should be involved in its development is thus a key question, as the selection of the participants influences which interests are taken into account. It is difficult to imagine a national forest policy that can be relevant and useful without being firmly placed within the broader aims of society. Forest policies thus not only have to cover issues under the competence of the forestry administration and its agencies, but they also need to contribute to overarching policies, including those responsible for national development or economic and poverty strategies. They also need to be consistent with policies issued by other government authorities, e.g. on environmental protection, climate change, agriculture, industry and trade. Thus, a forest policy is a policy for people, not for the forestry administration. Being an agreement among government and stakeholders, a national forest policy is endorsed by government and implemented through legal, economic and informational instruments, and by other stakeholders with their respective means. Ultimately, through government endorsement, a formal national forest policy is the official position of the government, as a clear statement of a country's goals and objectives, made public so that all parties know the directions being pursued and the outcomes to be achieved. If different actors each pursue their particular interests and change course frequently, larger goals or longer-term objectives are unlikely to be reached. Thus, there are a number of good reasons for jointly developing and using an agreed forest policy. The process of bringing stakeholders with diverse interests together to negotiate an agreement is extremely valuable in itself. A mutually accepted forest policy builds a sense of joint ownership, which is essential for its implementation. The involvement of stakeholders beyond the forest sector gives the policy legitimacy across society. Wide buy-in is particularly advantageous when negotiating with powerful ministries such as agriculture, energy, planning or finance. A national forest policy provides excellent guidance for developing more coherent institutional frameworks and policy instruments, including forest legislation. A national forest policy can guide the planning and operations of forestry stakeholders including administrations and agencies at various levels. A national forest policy facilitates communication, coordination and collaboration across government, non-governmental organizations and the public. A national forest policy can provide a solid basis for international policy discussions and for strengthening technical assistance cooperation. The national forest policy can serve as a reference to guide decisions on emerging issues, particularly those where quick, difficult or controversial decisions must be made. Integrating forest issues in broader policies addressing national sustainable development as well as the challenges associated with changes taking place at the global level may involve some risk (e.g. loss of control) but can open up considerable opportunities. For example, India, the Republic of Korea and the United States of America have linked forests and forest management to wider development agendas by making them part of "Green Deal" programmes, and Costa Rica and the Republic of Korea have made natural resources a central part of their national development strategies. Efforts are under way in many countries to improve integration of forest and climate change policies as well as forest and energy policies. Forest management is nothing but overall administrative, economic, legal, and social aspects, as well as scientific and technical aspects, such as silviculture, protection, and forest regulation. This includes management for aesthetics, fish, recreation, urban values, water, wilderness, wildlife wood products, forest genetic resources, and other forest resource values. Management can be based on conservation, economic, or a mixture of the two. Techniques include timber extraction, planting and replanting of various species, cutting roads and pathways through forests, and preventing fire. Some forests have been and are managed to obtain traditional forest products such as firewood, fiber for paper, and timber, with little thinking for other products and services. Nevertheless, as a result of the progression of environmental awareness, management of forests for multiple use is becoming more common. There has been increased public awareness of natural resource policy, including forest management. Public concern regarding forest management may have shifted from the extraction of timber for earning money for the economy, to the preservation of additional forest resources, including wildlife and old growth forest, protecting biodiversity, watershed management and recreation. Increased environmental awareness may contribute to an increased public mistrust of forest management professionals. But it can also lead to greater understanding about what professionals do for forests for nature conservation and ecological services. Many tools like GIS and photogrammetry modelling have been developed to improve forest inventory and management planning. The abundance and diversity of birds, mammals, amphibians and other wildlife are affected by strategies and types of forest management. Forest management varies in intensity from a leave alone, natural situation to a highly intensive regime with silvicultural interventions. Forest Management is generally increased in intensity to achieve either economic criteria (increased timber yields, non-timber forest products, ecosystem services) or ecological criteria (species recovery, fostering of rare species, carbon sequestration). The National Forest Policy, 1988, brought about a paradigm shift in the management of forests by acknowledging that the bonafide requirements of the villagers shall be the first charge on forest produce. In 1990 after the Government of India issued a circular on Joint Forest Management (JFM), enabling the states to initiate their own programmes. The forest departments then embarked on the partnership with the communities and two decades later the progress in the endeavour has been spectacular. JFM programmes are currently spanned in 29 states, represent 1,18,213 JFM committees protecting about 22.93 million hectare of forests. About one third of the land with the forest

department is being managed today in partnership with the people of the country. The JFM programme has also contributed significantly towards the economic well being of the people through increased availability of the forest resources, creation of employment opportunity and better flow of ecosystem services. Wherever a successful JFM programme has been implemented it has led to improvement in forests which in turn imply better availability of water and more crop yields and thus enhancing the livelihood and income of the people. The community assets created as part of the entry point activities has improved the infrastructure in the villages and supplemented the development efforts in the most remote and inaccessible habitations of India.

Key words: National Forest Policy, Forest Regulation, GIS and photogrammetry modeling, JFM programme

EVALUATION OF PROQUIZAFOP 2.5% + IMAZETHAPYR 3.75 % READY MIXTURE AGAINST WEEDS, GROWTH AND YIELD OF PIGEONPEA

AISHWARYA MANGARAJ^{1*}, M. L. KEWAT²

¹DEPARTMENT OF AGRONOMY, G. B. PANT UNIVERSITY OF AGRICULTURE & TECHNOLOGY, PANTNAGAR. ² DEPARTMENT OF AGRONOMY, JNKVV, JABALPUR.

A field experiment was conducted at the Livestock Farm, JNKVV, Jabalpur during Kharif season 2017 and 2018 to adjudge the efficacy of propaquizafop and imazethapyr ready mixture against weeds in pigeonpea. Species wise weed data were recorded in weedy check plots indicated that density of monocot weeds (51.09%) was practically same to that of dicot weeds (48.90%) in the experimental field. Among the monocots, Echinochloa colona (27.10%) was predominant followed by dicot weeds like Phyllanthus niruri (24.26%) and Alternanthera philoxeroides (16.40%) due to continuous germination of these weed seeds from soil. However, other monocot weeds like Cyperus rotundus, Cynodon dactylon, Commelina benghalensis, and dicots like Cichorium intybus were also present in less numbers. Among herbicidal treatments, post emergence application of propaquizafop+imazethapyr ready mixture at 55+80 g/ha arrested weed density and weed biomass production remarkably and proved superior to its lower doses (50+75 and 45+70 g/ha), fomesafen+fluazeop-p-butyl ready mixture (90+90 and 110+110 g/ha), alone application of imazethapyr (150 g/ha) and pendimethalin (1000 g/ha) as pre emergence. Yield attributing characters (pods per plant, seeds per pod, seed index) and yield (11.89 q/ha) were superior under propaquizafop+imazethapyr ready mixture applied at 55+80 g/ha followed by 50+75 g/ha and found more remunerative as compared to other herbicidal treatments including check herbicides and mechanical weed control.

Key words: Herbicide, Imazethapyr, Pigeonpea, Propaquizafop, Weed, Yield

DEVELOPING MAIZE HYBRIDS IN A CHANGING CLIMATE FOR FOOD AND NUTRITIONAL SECURITY IN EASTERN INDIA

ADITI GHOSH*, AMITAVA GHOSH, AND SABYASACHI KUNDAGRAMI

DEPARTMENT OF GENETICS AND PLANT BREEDING, INSTITUTE OF AGRICULTURAL SCIENCE, UNIVERSITY OF CALCUTTA, KOLKATA-700019, WEST BENGAL, INDIA

Eastern India is represented by West Bengal, Bihar and Odisha. They are highly subtropics in nature because of their high temperature and humidity which prevails almost major part of the year. Lately, there is a renewed interest for Maize as Fodder, feed and food. Maize in West Bengal covers an area of one hundred sixty thousand hectare but productivity is more than 4 tons/ha which is almost twice that of national average of 2.5 tons/ha.Much effort is devoted to increase its productivity. Simultaneously, quality becomes a core issue to provide nutritional security. The work has been initiated to develop maize hybrids with improved quality without compromising its yield potential. As many as 76 hybrids were raised involving 27 parents (25 QPM and 2Non-QPMinbreds). Based on yield performance over 3 years 10 best hybrids having 145-169g yield/plant were selected with exceptionally good cob characters (large cob and grain size as well high grain number). These selected hybrids were analyzed for ash, crude protein, amylose, carbohydrate and total carotenoid content. Quality wise among 10 hybrids three namely CUH57 (QPM x QPM), CUH50 (QPM x Non QPM) and CUH26 (Non QPM x QPM) appeared to be hybrids of choice. Of these CUH50 stood out because of its yield potentiality and enhanced quality where it recorded protein as high as 19%, ash close to 1.5 and amylose 55% but with moderate level of carotenoid. The hybrids endowed with higher yield potential and better seed quality profile present promising opportunity for cultivation.

Key words: Maize, Single cross hybrids, Yield, Nutritional quality

VEGETABLE GRAFTING- AN INNOVATIVE APPROACH IN OLERICULTURE ABHILASH SINGH¹, ASHISH K. SINGH¹, SANDEEP YADAV¹, SHUBHAM SINGH² 1. DEPARTMENT OF VEGETABLE SCIENCE, G. B.P.U.A & T., PANTNAGAR (U.K.) 2. DEPARTMENT OF VEGETABLE SCIENCE, I.A.R.I, PUSA, NEW DELHI

Grafting is an art of joining together two plant parts (a rootstock and a scion) by means of tissue regeneration, in which the resulting combination of plant parts achieves physical reunion and grow as a single plant. Grafting of fruit trees has been practiced from thousands of years but in vegetables, grafting is a relatively new technique which is a centuries-old technique. Commercial vegetable grafting using resistant roots stocks is one of the best tools for sustainable vegetable production. Vegetable grafting reduces dependence on the agrochemicals for organic production. Vegetable grafting also induces vigour, precocity, better yield and quality, survival rate, reduce infection by soil-borne pathogens and tolerance against abiotic stresses by using desired rootstocks. This study was designed to control soil-borne disease especially fusarium and to improve crop productivity in watermelon (*Citrullus lanatus*) by grafting the seedlings onto squash rootstock (*Cucurbita moschata*). After this scientific documentation, grafting in vegetables particularly in cucurbits started scattering from Japan to other neighboring countries like Korea, China, etc. and initiated to manage soil-borne diseases especially Fusarium. Subsequently, the production of watermelon grafted seedlings at commercial level started in the early 1930s in Japan. Considering the diverse applications of vegetable grafting worldwide, this technique has the potential to solve the problems of the vegetable industry of India and can boost farmer's income by improving the crop yield and reducing the cost incurred on purchasing of the huge amount of fertilizers and pest and disease control products.

Key words: Grafting, Technique, Yield, Resistance.
IMPACT OF BIO-ENHANCER FOR QUALITY PRODUCTION OF DIFFERENT HORTICULTURAL CROPS

AKHAND PRATAP SINGH, ANKIT SINGH BHADAURIA, SHARDULYA SHUKLA ^{1,2}RESEARCH SCHOLAR AT C. S. AZAD UNIVERSITY OF AGRICULTURE & TECHNOLOGY, U.P. ³RESEARCH SCHOLAR, DIHAR, DRDO, BASE LAB CHANDIGARGH, PUNJAB

Imbalance, inadequate and indiscriminate use of chemical fertilizers reduce the quality production of horticultural crops due to the harmful effect on mechanism and physiology of seedlings as well as saplings and also affected the soil fertility, crop productivity and environment. Under these hazardous situations we need to apply effective bio-enhancer instead of chemical fertilizers and pesticides in quality production of horticultural crops. In modern era we are facing several problems vis. worst nutritive value and carcinogenic property in food that's why we need to promote application of bio-enhancer at large. In upcoming henceforth bio-enhancer could be an alternative of chemicals in respective manners and also play vital role in organic production of horticultural crops. As an alternative number of organic farmers devised organic boosters bassed on local experiences and gave specific names such as *Amritpani, Pachagavya, Beejamrita and Jeevamrita etc.* Review of available literature with bio-enhancer indicates that there is immense scope for it's promotion in horticulture. **Keywords**- Carcinogenic, Organic boosters and bio-enhancer *etc.*

RECENT ADVANCES IN STORAGE OF HORTICULTURAL CROPS

ARCHIT SINGH,* SHIVKANT SINGH CHANDEL AND RAVI PRATAP SINGH DEPARTMENT OF HORTICULTURE, INSTITUTE OF AGRICULTURAL SCIENCES, BANARAS HINDU UNIVERSITY, VARANASI – 221005 (U.P.) INDIA

Storage is one of the important post harvest aspect which facilitates the regulated distribution and extending the duration of the horticultural produce availability. Storage increase the period of consumption, check losses, reduce glut, regulate supply and helps to obtain better price of the produce. Horticultural crops are high value commercial crops and play a unique role in countries economy, nutritional security, poverty alleviation and employment generation. Nearly 25-40% of our horticultural produce, especially fruits and vegetables are wasted, mainly on account of poor cold storage and other storage facilities. Wastage of fruits and vegetables due to poor post-harvest management and lack of cold chain facilities have been estimated to cost up to Rs 500 billion annually. Orderly marketing perishable commodities often requires some storage to balance day to day fluctuation between product harvest and sales to extend the market period. Although, refrigerated storage is ideal for long term storage of fruits whereas on farm storage is economical for short term storage. Non refrigerated storage like Zero energy cool chamber is best storage system for rural areas because it does not need energy. Therefore, cost of storage is much less in comparison to refrigerated storage. While non refrigerated storage structures require considerable investment, traditional methods are cheaper. In spite of energy scarcity modern storages are essential for India to ensure the better price to growers and simultaneously to make available quality products to the consumers throughout the year. In addition undernourishment problems of the country can also be counter to some extent by enhancing the storage infrastructure facilities. The wastage or losses can be checked by adoption of the advances methods of storage.

Keywords: Storage, fruits, refrigerated, non refrigerated, post harvest

PRESENT STATUS AND RELEVANCE OF TRANSGENIC CROPS IN INDIA

AMRITA GIRI¹ AND SADHNA SAHA²

1&2DEPARTMENT OF GENETICS AND PLANT BREEDING, IGKV, RAIPUR (C.G.)

The term 'transgenic' was first used by Gordon and Ruddle, it individuals contains a new gene inserted into them by gene technology. The gene technology is also referred to as transgenic technology, genetic engineering and rDNA technology. A transgenic crop plant contains one or few gene which has been artificially inserted by passing the sexual process. Direct and indirect methods are used for inserting foreign DNA into crop plants. The area of agricultural land used for production of transgenic GM crops has increased at an unprecedented speed since these crops were introduced 17 years ago. The cultivation area is now over the 170 million hectares distributed among 29 countries worldwide. In India, Bt cotton is the only crop approved for commercial cultivation. From a low initial uptake in 2002, Bt cotton has spread to over 93% of the cotton area by 2012 covering 11.2 million hectares. After touching 12.85 million hectares in 2014-15, cotton area subsequently declined in India to around 10.5 million hectares by 2016-17 mainly due to pest (whitefly, pink bollworm etc.) attacks. Union MoEF will soon convene special meeting of GEAC to decide on field trial approvals for transgenic mustard (DHM-11). The potential of GM plants to meet the requirements of growing population is not being recognized at present. This is a consequence of concerns raised by the public and the critics about their applications and release into the environment. These include effect on human health and environment, biosafety, world trade monopolies, trustworthiness of public institutions, integrity of regulatory agencies, loss of individual choice, and ethics as well as skepticism about the real potential of the GM plants, and so on. **Key words**- Transgenic crops, Bt cotton, GMO.

STANDARDIZING FREEZING TECHNIQUES FOR MANGO (MANGIFERA INDICA L.) SLICES CV. ALPHONSO AND ITS STORAGE BEHAVIOR

ASHWINI A. CHOTHE¹, DHANASHRI V. THORAT², KANCHAN N. LENGURE³

¹DEPARTMENT OF POST HARVEST TECHNOLOGY, ²DEPARTMENT OF AGRONOMY, ³ DEPARTMENT OF FOOD MICROBIOLOGY, K. K. WAGH COLLEGE OF FOOD TECHNOLOGY, NASHIK, (MH)422003

The present investigation entitled "Standardization of freezing techniques of mango (*Mangifera indica* L.) slices cv. Alphonso" was conducted at Department of Post Harvest Management of Fruit, Vegetable and Flower Crops, P.G. Institute of. Post Harvest Management, Dapoli, Dist. Ratnagiri (M.S.) during the year 20011-2012. The experiment was conducted in F.C.R.D with two factors viz., dipping period in liquid nitrogen (0, 45, 60 and 75 seconds) and storage period (0, 1 and 2 months). Among the treatments 45 seconds dipping shows

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better retention of total soluble solids and less retention of acidity. The decreasing trends in reducing sugar and increasing total sugar, ascorbic acid were observed after 60 days storage. The result showed that ripe Alphonso mango slices immersed in liquid nitrogen for period of 45 seconds and stored at -20° C up to period of two months were found to be organoleptically accepted with safe level of microbial count when packed in 400 gauge food grade LDPE pouches. The dipping period for 75 seconds shows the highest drip loss of frozen mango slices after thawing than other treated one.

Key words: - Freezing, frozen storage, liquid nitrogen, drip loss

EVALUATION OF ALLELOPATHIC IMPACT OF SORGHUM AND SUNFLOWER ON GERMINATION ASPECTS OF *PHALARIS MINOR* AND WHEAT

ARYA KUMAR SARVADAMANA

DEPARTMENT OF AGRONOMY, G. B. PANT UNIVERSITY OF AGRICULTURE & TECHNOLOGY, PANTNAGAR

A laboratory experiment was carried out to assess the allelopathic effect of aqueous extracts of sorghum and sunflower on germinating seeds of *Phalaris minor* and wheat. 10% (w/v) aqueous extracts of sorghum and sunflower were applied on the seed of *Phalaris minor* and wheat and the parameters like germination percent, relative germination ratio, speed of germination, mean germination time, days to 50% germination were calculated. In all the calculated parameters it was found that the aqueous extracts of both sorghum and sunflower are highly allelopathic to *Phalaris minor* and they have a very little impact on wheat. Both sorghum and sunflower aqueous extracts significantly reduced the germination of *Phalaris minor* as compared to control (distilled water), but sunflower was more allelopathic than sorghum with 85.5% of germination inhibition. Germination percent, relative germination was found non-significant for wheat but highly significant in *Phalaris minor*. Days to 50% germination was found non-significant for both wheat and *Phalaris minor*, while there was significant variation with respect to mean germination time in both the type of seeds. **Keywords**: Allelopathy, Germination percent, Sorghum, Sunflower, Weed

RESIDUAL EFFECT OF APPLIED VERMICOMPOST AND NPK TO RICE ON GROWTH AND YIELD OF SUCCEEDING WHEAT AND CHEMICAL PROPERTIES OF SOIL

AMIT KUMAR1, B.P. DHYANI1, ASHISH RAI*2 AND VIPIN KUMAR2

1DEPARTMENT OF SOIL SCIENCE, SARDAR VALLABHBHAI PATEL UNIVERSITY OF AGRICULTURE & TECHNOLOGY, MEERUT, UTTAR PRADESH-INDIA

2DEPARTMENT OF SOIL SCIENCE AND AGRICULTURAL CHEMISTRY, INSTITUTE OF AGRICULTURAL SCIENCES, BANARAS HINDU UNIVERSITY, VARANASI, UTTAR PRADESH-INDIA

Two consecutive field experiments after rice crop were conducted during 2011-12 and 2012-13 in the Crop Research Centre, of Sardar Vallabhbhai Patel University of Agriculture and Technology, Uttar Pradesh. Ten different treatments were implied to evaluate the residual effect of vermicompost and applied inorganic fertilizers on wheat crop. Significantly taller plants than T2 during both the years were measured in those treatments where 4 ton vermicompost was applied in rice. Spike length and test weight of wheat remained unaffected due to residual effect while the number of grains per spike was significantly affected. Grain yield varied from 20.00 to 48.70 and 21.30 to 49.50 q ha-1 during 2011-12 and 2012-13, respectively while straw yield 36.35 to 71.24 and 39.53 to 73.04 q ha-1 during 2011-12 and 2012-13, The maximum grain yield 48.70 and 49.50 q ha-1 during 2011-12 and 2012-13, respectively and straw yield 71.24 and 73.04 q ha-1 was recorded in T10 where along with 50% N, 100% P and K 4 ton vermicompost was applied in rice at flowering and 100% NPK to wheat. Residual effect of 4 ton vermicompost application on available soil K was significant. Organic carbon (%), pH and electrical conductivity (dSm-1) were not significant. **Keywords**: Residual effect, vermicompost, yield attributes, grain yield, straw yield and chemical properties of soil

STUDIES ON INSECT PESTS OF CABBAGE WITH SPECIAL REFERENCE TO SEASONAL INCIDENCE AND MANAGEMENT OF DIAMOND BACK MOTH

ARCHANA KERKETTA*, JAISHREE BANJARE* AND MADAN KUMAR JHA AND PRITANSHA BHAGAT *DEPARTMENT OF ENTOMOLOGY, COLLEGE OF AGRICULTURE, INDIRA GANDHI KRISHI VISHWAVIDYALAYA, RAIPUR, CHHATTISGARH

DEPARTMENT OF VEGETABLE SCIENCE, IGKV, RAIPUR, CHHATTISGARH

The experiment was conducted during the course of study data were recorded on 5 randomly selected plants for the presence of insect pests and natural enemies throughout the cropping season November, 2016 to February, 2017. In the field, Aphid (*Brevicoryne brassicae*, *Lipaphis erysimi, Myzus persicae*), Semi lopper (*Trichoplusia ni*), Diamond back moth (*Plutella xylostella* L.) Tobacco caterpillar (*Spodoptera litura*), Cabbage head borer (*Hellula undalis*), Flea beetle (*Phyllotreta cruiciferae*) and Green sting bug (*Nezara viridula*) as the major pests and some natural enemies recorded were *i.e.* Lady bird beetles (*Menochilus sexmaculatus* Fabricius, *Coccinella transversalis*), Rove beetle (*Paederus fuscipes*), larval endoparasitoid (*Cotesia plutellae*), Hover flies (*Toxomerus geminetus*) etc. were observed on Cabbage (Golden acre). The maximum larval population of diamond back moth was recorded during second week of January. The larval population of diamond back moth, minimum temperature, evening and average relative humidity, sun shine and rainfall were showed positive correlation and maximum, average temperature, morning relative humidity had negative correlation with diamond back moth during whole cropping season.

Keywords: Cabbage, Insect and DBM

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EFFECT OF MICRO NUTRIENTS ON GROWTH, YIELD AND QUALITY OF CABBAGE (BRASSICA OLERECEA L. VAR. CAPITATA)

ANKIT SHARMA^{*1}, MADAN KUMAR JHA AND RISHABH DUBEY

DEPARTMENT OF HORTICULTURE, FACULTY OF AGRICULTURAL SCIENCES AND TECHNOLOGY AKS UNIVERSITY, SHERGANJ, SATNA (M.P)

2 DEPARTMENT OF VEGETABLE SCIENCE IGKV, RAIPUR (C.G.)

3DEPARTMENT OF HORTICULTURE, FACULTY OF AGRICULTURAL SCIENCES AND TECHNOLOGY AKS UNIVERSITY, SHERGANJ, SATNA (M.P)

The field experiment was conducted during Rabi season of 2017-18 at the Horticulture Research farm, AKS university, Satna (M.P.). The experiment was laid out in a randomized block design with three replications. The treatments consisted of eleven combination of different agro input management practices viz., treatments 100% RDF+Fe 0.5% (T1), 100% RDF+Fe 1.0% (T2), 100% RDF+Zn 0.5% (T3), 100% RDF+Zn 1.0% (T₄), 100% RDF+Mn 0.5% (T₅), 100% RDF+Mn 1.0% (T₆), 100% RDR+B 0.3% (T₇), 100% RDF+ B 0.6% (T₈), 100% RDF+ Fe (0.5%) + Zn (0.5%) + Mn (0.5%) + B (0.3%) (T₉), 100% RDF+ Fe (1.0%) + Zn (1.0%) + Mn (1.0%) + B (0.6%) (T₁₀), 100% RDF Control (T₁₁). The maximum net profit/ha was recorded under treatment T₃ (Rs.62,037) while minimum net profit/ha was obtained in treatment T₁₁ (Rs. 40,185). The maximum gross profit/ha was recorded in treatment T₃ (Rs. 1, 29,629) whereas, minimum gross profit/ha was recorded in treatment T₁₁ (Rs. 1,05,000). Thus, the maximum income (both gross and net) was obtained with T₃. The significantly maximum B:C ratio 1.93 was recorded under the treatment (T₃). And the minimum B:C ratio 1.62 was recorded under the treatment (T_{11}) .

Keywords: Micro nutrient and Cabbage

SUSTAINABLE DEVELOPMENT, CLIMATE CHANGE AND INDIAN CULTIVATION: AREA PERSPECTIVES ANU AND VIKRAM SINGH

DEPARTMENT OF GENETICS & PLANT BREEDING, CHAUDHARY CHARAN SINGH HARYANA AGRICULTURAL UNIVERSITY, HISAR, HARYANA (125004), INDIA

Climate change is a major global environmental problem and a matter of great concern to a developing country like India, which has tremendous reasons to be concerned about the impacts of it. The projected climate change under various scenarios is likely to have implications on food production, water supply, coastal settlements, forest ecosystems, health, energy security, etc. The major effects can be generalized as changes in the geographical limits to agriculture, changes in crop yields and impacts on agricultural system. Further, Indian agriculture is particularly sensitive to climate change aroused vulnerability. It is necessary to understand the impact arising due to climate change on the adaptive capacity of communities in developing countries. The issue of highest importance to developing countries is reducing the vulnerability of their natural and socio-economic systems to the projected climate change. India and other developing countries will face the challenge of promoting mitigation and adaptation strategies, bearing the cost of such an effort, and its implications for economic development.

Key words: Climate change, agriculture, vulnerability, adaptation and sustainable development

PREMATURE GROWTH PERFORMANCE OF POPLAR CLONES

ANITA TOMAR AND ANUBHA SRIVASTAV

FOREST RESEARCH CENTRE FOR ECO-REHABILITATION, PRAYAGRAJ, UTTAR PRADESH, INDIA

Poplars hold a place of great significance in India as they are among the most preferred tree species in the unique agroforestry systems in northern part of the country. To assess suitability of poplar clones, specifically for eastern Uttar Pradesh region twenty poplar clones viz . AM -48, AM - 49, AM -41, BR -510, AM -50, FS -18, FS -190, FS -155, L -90, L -87, L -89, S7 C1, S7 C15, S7 C20, S7 C4, L -200-84 UDAI ,KRANTI,BAHAR and G- 48 were tested in Prayagraj district laying at latitude 25007' to 25010'N and longitude 81054' to 81058' E and at 98 m elevation. This trial was established in year 2017 by the clones from Forest Research Institute (FRI), Dehradun. Procured. The performance after two years were tested on the basis of height and girth. The highest height was recorded in poplar clone S₇ C₂₀ (7.65 m) followed by L-87 (7.13 m). The clone L-87 recorded maximum girth (5.08 cm). The clones viz. S7 C4 , L -200-84 UDAI ,KRANTI ,BAHAR are doing quite well whereas AM and BR series clones showed poor performance. This paper, analyzed premature growth of poplar clones to get an idea about suitability of poplar based agroforestry in the Prayagrai region which is considered unsuitable for poplar plantation.

Keywords: poplar, agro forestry, trial, clone, performance, plantation

INFORMATION COMMUNICATION TECHNOLOGIES FOR TRANSFER OF TECHNOLOGY ARPITA SHARMA¹ AND NARESH KUMAR KANDPAL²

¹DEPT. OF AGRICULTURAL COMMUNICATION, COLLEGE OF AGRICULTURE, GBPUA&T, PANTNAGAR, UTTARAKHAND.

²SENIOR SUB EDITOR OF HINDUSTAN, UTTARAKHAND.

Information Communication Technologies are huge umbrella term which plays an important role in the development of farmers. In India women play an important role in the farming sector. In most of the cases various farmers are divorced from technologies. According to IFPRI, agricultural extension (also known as agricultural advisory services) plays a crucial role in promoting agricultural productivity, increasing food security, improving rural livelihoods, and promoting agriculture as an engine of pro-poor economic growth. Past researches showed that women has less knowledge about the farming equipments and various other new technologies. There are various ICTs tools as radio, television, mobile phone which provides recent information to many of the people. These ICTs are useful to provide timely and relevant information among the rural community. The main role of ICTs is to connect farmers with the information. Present paper aim is to discuss about various ICTs tool for the development of farmers.

Key words: ICT, doubling, income, farmers

LASTING IMPACT ON FARMER'S LIVELIHOOD THROUGH HIGHTECH-HORTICULTURE

ANKIT SINGH BHADAURIA, AKHAND PRATAP SINGH, HARSHIT TRIPATHI C.S. AZAD UNIVERSITY OF AGRICULTURE & TECHNOLOGY, KANPUR (U.P.)

Horticulture plays very crucial role for food and nutritional security. As we know that horticulture is the technology which is modern, less environment dependent and capital intensive but with a capacity to improve productivity and farmers income. As per the PM concern, traditional crops can't contribute for increasing income of the farmers. Thus today's requirement to promote the high-horticultural activities such as High density planting system, proper Integrated nutrient management, mulching, fertigation and protected cultivation for increasing per capita income of the farmers. The mission of GOI is "Doubling of farmer's Income" by 2022 for which it will play very effective role. We must focus on those points which have skipped generally by the farmers which directly or indirectly effect the living standard of indian farmers. We should follow the effective measures which can uplift them and to make them stable in terms of basic needs of the farmers. **Keywords** – HDP, Protected cultivation, Fertigation and Mulching

GPS-GIS BASED SOIL FERTILITY MAPS OF SANGAMNER TAHSIL OF AHMEDNAGAR DISTRICT (M.S.)

B.C.CHAUDHARI, A.L.PHARANDE, G.D.PATIL AND A.G.DURGUDE DEPARTMENT OF SOIL SCIENCE AND AGRIL. CHEMISTRY K.V.PATEL COLLEGE OF AGRICULTURE, SHAHADA DIST- NANDURBAR DIRECTOR OF INSTRUCTION M.P.K.V. RAHURI DEPARTMENT OF SOIL SCIENCE AND AGRIL. CHEMISTRY, COLLEGE OF AGRICULTURE, KOLHAPUR

DEPARTMENT OF *DEPARTMENT OF SOIL SCIENCE AND AGRIL. CHEMISTRY*, M.P.K.V. RAHURI Plant nutrients supply from chemical fertilizers plays a vital role in increasing agricultural production by enhancing the soil quality and productivity. The GPS and GIS techniques i.e. (Global Position System and Geographical Information System) are widely utilized for delineating fertility maps of macro and micronutrients. The study entitled GPS-GIS based soil fertility maps of Sangamner tahsil of Ahmednagar District (M.S) was conducted during the year 2013-2014 and 2014-2015 at Department Soil Science and Agriculture Chemistry, Post Graduate Institute MPKV, Rahuri to study the chemical properties of soils of Sangamner tahsil by using Global Positioning System (GPS).

Keywords: Sangamner tahsil; GIS; GPS and soil fertility maps.

GPS-GIS BASED SOIL FERTILITY MAPS OF AKOLE TAHSIL OF AHMEDNAGAR DISTRICT (M.S.)

B.C.CHAUDHARI, A.L.PHARANDE, G.D.PATIL AND A.G.DURGUDE DEPARTMENT OF SOIL SCIENCE AND AGRIL. CHEMISTRY K.V.PATEL COLLEGE OF AGRICULTURE, SHAHADA DIST- NANDURBAR DEAN (F/A) & DIRECTOR OF INSTRUCTION M.P.K.V. RAHURI DEPARTMENT OF DEPARTMENT OF SOUL SCIENCE AND AGRIL. CH

DEPARTMENT OF DEPARTMENT OF SOIL SCIENCE AND AGRIL. CHEMISTRY, COLLEGE OF AGRICULTURE, KOLHAPUR

DEPARTMENT OF DEPARTMENT OF SOIL SCIENCE AND AGRIL. CHEMISTRY, M.P.K.V. RAHURI

The GPS and GIS techniques i.e. (Global Position System and Geographical Information System) are widely utilized for delineating fertility maps of macro and micronutrients. The study entitled GPS-GIS based soil fertility maps of Akole tahsil of Ahmednagar District (M.S) was conducted during the year 2013-2014 and 2014-2015 at Department Soil Science and Agriculture Chemistry, Post Graduate Institute MPKV, Rahuri to study the chemical properties of soils of Akole tahsil by using Global Positioning System (GPS). Major portion of the study area in Sangamner area registered alkaline in nature, moderately safe in respect of EC, low in organic carbon, nitrogen, sulphur, iron and zinc, high in calcium carbonate, potassium, and molybdenum and medium in phosphorus. The 100 percent area of ex. calcium and magnesium, manganese and copper was observed sufficient in the soils collected from Sangamner area. The 51 per cent soil samples were observed in sufficient range in respect of silicon. The 59 per cent soil samples were observed in deficient range in respect of boron. Where major portion of the study area in Akole registered neutral in soil reaction, it was safe in respect of EC, low in organic carbon, nitrogen, ex. magnesium, iron, zinc, and medium in calcium carbonate, high in phosphorus, potassium, ex. Calcium, molybdenum, whereas, the 100 percent area of Akole found deficient in available sulphur and sufficient in manganese and copper content of soil. The 66 per cent soil samples were observed deficient in respect of silicon and 46 per cent soil samples were observed in deficient in boron content in Akole tahsil. The pedons of Sangamner were classified as clayey (Typic Haplustert (P4), Typic Haplustept (P5) and Typic Ustorthent (P6). The pedon P4 and P5 were suitable for growing sugarcane crop. However, pedon P6 is not suitable for growing sugarcane because it has shallow depth of soil. It will be suitable for growing pomegranate and vegetables. However the pedons from Akole were classified as clayey (Typic Haplustert (P1); Typic Haplustept (P2) and clay loam texture of Typic Ustorthent (P3). The pedon P1 and P2 were suitable for growing sugarcane and pedon P3 is shallow depth and suitable for growing onion, pomegranate and vegetables. This approach is proposed as a method for the evaluation of sustainable soil management. The fertility maps could be used to predict potentials and constraints of land for specific crop production. The soil test values have further been utilized for prescribing fertilizer recommendations for optimum crop production in order to maintain the soil fertility, productivity, sustainability and better crop quality. This data and fertility maps will be helped in planning, maintaining the fertility, productivity and quality of growing crops viz., pomegranate, sugarcane, onion, cabbage, tomato, cauliflower, chilli, brinjal and particularly in forage crop lucerne etc. in the soils of Sangamner and Akole tahsil except paddy which was growing in western part of Akola tahsil.

Keywords: Akole tahsil; GIS; GPS and soil fertility maps.

EFFECT OF RHIZOBIUM, ALONE AND IN COMBINATION WITH NEEM PRODUCT AGAINST EARLY BLIGHT ALTERNARIA SOLANI (ELL & MART) DISEASE OF POTATO

BHUNESH DIWAKAR^{*1} AND MADAN JHA DEPARTMENT OF PLANT PATHOLOGY (SHUATS) ALLAHABAD, (U.P.) DEPARTMENT OF VEGETABLE SCIENCE (IGKV) RAIPUR (C.G.)

The present investigation entitled "Effect of Rhizobium, alone and incombination with Neem Product against Early Blight *Alternaria solani* (Ell & Mart) disease of Potato" was conducted at the Experimental field of the Dept. of Plant Pathology, Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad. The experiment was carried out on plot basis in Randomized Block Design with 8 treatments and 3 replications. Leaves were collected in a clean polythene bag and brought to the laboratory from infected potato plant having characteristic symptoms of disease. The PDA medium was prepared and the infected leaf was transferred into the medium. The slide was then prepared from the culture using lactophenol and cotton blue and observed under microscope to confirm the presence of *Alternaria solani* (Ell & Mart). But from the farmer's point of view, the economics of disease management is important. In the present investigation cost benefit ratio was worked out, all the treatments were economically good compared with control but the most economical treatment was Neem oil (1:1.99) cost benefit ratio Neem seed kernel extract (1:1.68), Neem leaf extract (1:1.99), Neem cake (1:1.86), Neem bark (1:1.87) and Rhizobium produced (1:1.68) as compared to treated control Carbendazim (1:2.21) and untreated control (1:1.49).

Keywords: Early blightt and Potato.

EFFECT OF VARIOUS NPK REGIMES ON GROWTH AND YIELD COMPONENTS IN DIFFERENT RICE (*ORYZA SATIVA* L.) GENOTYPES

BABITA JOSHI¹. S K GURU²

^{1,2}DEPARTMENT OF PLANT PHYSIOLOGY, COLLEGE OF BASIC SCIENCES AND HUMANITIES, GB PANT UNIVERSITY OF AGRICULTURE AND TECHNOLOGY, PANTNAGAR

Modern production technologies necessitate intensive and high dose fertilizer use in a balanced manner. However the translation of nutrient application into yield is complex. It is affected by the genotype, soil physical characteristics, basic soil fertility, soil organic matter, climate as well as physiological efficiency of dry matter partitioning. Keeping in view the aforesaid facts, a field study was conducted in kharif season of 2017 and 2018 at GBPUA&T, Pantnagar, India with the objective to assess effect of different NPK regimes along with certain components of integrated nutrient management on the growth and yield components of different rice genotypes. Six different rice genotypes viz. PR-113, PD-22, HKR-47, PD-24, NDR-359 and PD-19 were subjected to four variations in the recommended dose of fertilizers (RDF) i.e. 50% RDF (N (60:30:20 kg NPK ha⁻¹), 100% RDF (120:60:40 kg NPK ha⁻¹), 150% RDF (180:90:60 kg NPK ha⁻¹) and 50% RDF+ FYM(5 Tonnes ha⁻¹) and their growth parameters were observed at flowering, tillering and maturity stages along with the yield components. Results conclude that incremental doses of N, P and K over the recommended levels significantly improved the growth parameters as well as yield components. The maximum values of these parameters were recorded for 150% RDF (180:90:60 kg NPK ha⁻¹). Substituting FYM along with 50% RDF dose, resulted into numerically higher values for growth and yield related parameters as compared to 50% RDF only plants. However the observed values were significantly less than 100% RDF treated plants for most of the parameters with few exceptions.

PROBLEMS OF SUGARCANE FARMERS IN PILIBHIT DISTRICT OF UTTAR PRADESH

BHAGWAN DAS¹, PUKHRAJ SINGH², LALIT KR. VERMA³, TARUN KR. SHARMA⁴ ^{1,2,3} DEPTT. OF AG. ECONOMICS, ⁴DEPTT. OF AG. BOTANY, J.V. COLLEGE, BARAUT (BAGHPAT)

Sugar is the second largest agro-based industry in India. The industry provides employment to skilled and semiskilled workers mostly from rural areas. Sugar Industry is one of the largest farms based industry and plays a very important role in the Indian Economy. The Industry Affects the agriculture sector and the people related to it through the forward and backward linkages. Though the industry contributes a lot to the socioeconomic development of the nation, it is plagued with a number of problems such as Low Yield of Sugarcane ,Short crushing season, Fluctuating Production Trends, Low rate of recovery ,High cost of Production, ,Competition with Khandsari and Gur, high support prices payable to farmers, lack of adequate working capital, partial decontrol and the uncertain export Outlook, Regional imbalances in distribution, , Low per capita consumption etc.

Keywords: Agro-industry, Indian Economy, Working capital and export outlook.

IN VIVO BIOEFFICACY OF FUNGICIDES, BIOAGENTS AND BOTANICALS AGAINST POWDERY MILDEW OF CHILLI KUBDE ASHWINI VISHWANATHRAO

DEPARTMENT OF PLANT PATHOLOGY, V.N.M.K.V., PARBHANI

An experiment was undertaken for *in vivo* bioefficacy of fungicides, bioagents and botanicals in the field of Vegetable Research Center, VNMKV, Parbhani during *kharif* 2015 for powdery mildew of chilli. The results of disease management experiment through fungicides indicated that disease severity and incidence declined only after second and third spray. The disease incidence and severity after third spray ranges from 25.00 to 37.75 per cent and 16.35 to 27.13 per cent respectively. On the basis of effectiveness in controlling the powdery mildew of chilli most effective fungicide recorded in the order of merit Sulfex (63.03%), Penconazole (59.88%) and Hexaconazole (58.85%). Incidence and severity of powdery mildew disease on chilli after second botanical spray ranges from 41 to 51.37 per cent and 29.90 to 42.46 per cent. Among all the botanicals Garlic and Tulsi were superior over all the others. All bioagents effectively control the disease. After second spray disease incidence reduces in the range of 18.78 to 40.50 per cent. On the basis of effectiveness in controlling the powdery mildew of chilli most effective bioagents recorded in the order of merit *Trichoderma harzianum* (90.60%), *Trichoderma viride* (89.26%) and *Trichoderma koningii* (88.07%).

Keywords: Powdery mildew, chilli, Fungicides, Botanicals and Bioagents.

IMPACT OF VERMICOMPOST AND BIOFERTILIZERS ON GROWTH, YIELD AND FRUIT QUALITY OF STRAWBERRY (*FRAGARIA* × *ANANASSA* DUCH.) CV. CHANDLER.

BAVDEEP SINGH, DILIP SINGH KACHWAYA, JAGMEET SINGH, GURPIAS SINGH AND MANJINDER SINGH DEPARTMENT OF AGRICULTURE, MATA GUJRI COLLEGE, SRI FATEHGARH SAHIB, PUNJAB -140406, INDIA

The experiment was conducted at the Experimental farm, Department of Agriculture, Mata Gujri College, Sri Fatehgarh Sahib, Punjab during 2017-18 to study the effect of vermicompost and biofertilizers on growth, yield and fruit quality of strawberry (*Fragaria* × *ananassa* Duch.) cv. Chandler in central plain region of Punjab. The Experiment was laid out in Randomized Block Design with 9 treatments replicated thrice. Treatments consisted of vermicompost and biofertilizers (Arka Microbial Consortium, phosphate solubilizing bacteria and *Azospirillum*). Each treatment alone and their combination has shown significant effects on most of the parameters, but the combination of vermicompost, Arka Microbial Consortium, PSB and *Azospirillum* showed highest number of leaves per plant (28.77), leaf area (134.67 cm²), leaf area index (4.35), berry length (42.69 mm), berry breadth (30.76 mm), berry weight (16.16 g), total soluble solid (12.83 ⁰Brix) and ascorbic acid (60.30 mg/100 g pulp). The maximum yield per plant (150.53 g) and yield per hectare (8.49 tones) was recorded in treatment T₉ (AMC @ 7 kg/ha + VC @ 5 tones/ha + PSB @ 7 kg/ha + *Azospirillum* @ 7 kg/ha). Hence, on the basis of overall findings of present investigation, T₉ (AMC @ 7 kg/ha + VC @ 5 tones/ha + PSB @ 7 kg/ha + *Azospirillum* @ 7 kg/ha) significantly exhibited the maximum effect on higher vegetative growth, yield and fruit quality.

Keywords: Strawberry, Vermicompost (VC), AMC (Arka Microbial Consortium), Azospirillum, PSB, growth, yield and quality.

GROWTH RATE ANALYSIS AND ASSESSMENT OF DIFFERENT INFLUENCING FACTORS OF BOVINE POPULATIONS IN KARNATAKA

BISHVAJIT BAKSHI^{1*}, V. MANJUNATH¹, PRAMIT PANDIT²

¹DEPARTMENT OF AGRICULTURAL STATISTICS, APPLIED MATHEMATICS AND COMPUTER SCIENCE, UNIVERSITY OF AGRICULTURAL SCIENCES, BENGALURU, KARNATAKA, INDIA, 560065 ²DEPARTMENT OF AGRICULTURAL STATISTICS, BIDHAN CHANDRA KRISHI VISWAVIDYALAYA, MOHANPUR, NADIA, WEST BENGAL, INDIA, 741252

Livestock production plays a major economic and cultural role in rural community. It provides indirect insurance against risk of crop failure due to natural calamities like drought and flood. In the present study, an exertion has been made to appraise the compound annual growth of different bovines for different agro-climatic zones of Karnataka and for the entire state as well. Later, an attempt was also made to identify and quantify different factors' influence on the growth of bovines. The investigation was based on district wise secondary data of five consecutive quinquennial livestock census (1990-2012). From the computed compound annual growth rate (CAGR) for different bovine species in different agro-climatic zones over four different study period, it was found that the cattle and buffalo population for the entire state had declined, however, the population of sheep and goat had shown an increasing trend, causing an increasing growth rate for the total bovines of the state. From the outcome of the impact analysis, it was revealed that the growth rate of bovine populations in Karnataka had been majorly influenced by net irrigated area, net sown area, area under pulse crop, area under cereals and total number of cultivars in the state. Net sown area, net irrigated area and total number of cultivars had significantly positive effect throughout the study period, however, other three factors viz., area under pulse crop, area under cereals and literacy rate of the state had shown a negative impact on the growth rate of bovine populations.

Keywords: Agro-climatic zones, Bovine, Compound Annual Growth Rate (CAGR), Impact analysis, Regression analysis.

DOUBLING THE FARMERS INCOME THROUGH INNOVATIVE APPROACH.

BHAGYASHREE¹, ABHILASHA²

DEPARTMENT OF AGRONOMY, INSTITUTE OF AGRICULTURAL SCIENCES, BANARAS HINDU UNIVERSITY, VARANASI-221005

Innovative Approach for Doubling the income of the Farmers is the recommendations to revitalize agriculture and protect Farmers from vagaries of nature and price volatility and leads to the substantial increase in their income. These can be made possible only through emphasizing on seeds (Improved, innovative and hybrids ones),Irrigation systems(water potential and saving technology),Transport and storage (Farm-gate modern pack- houses, cold storages and reefer transportation), Food Processing Techniques,Marketing & Procurement (e-NAM and other information and communication technologies), Insurance and Integrated Farm Management Systems (Livestock Farmings,Farming Systems).Various bio-engineered techniques are used for the improvement of plants/crops. These can be applied on the production of fruits and vegetables of which India is one of the top producing countries in the world. In the irrigation systems, there should be minimal expenditure on non renewable inputs in the form of diesel to lift water through the pumps ,the use of solar power should be there instead. Modern irrigation techniques- Sprinkler and Drip irrigation systems should be used. Tower irrigation system is a low cost device for large area coverage. Enumerative price to farmers at 50% higher than the MSP works well.Minimum Support Price offered by the Government is high for the crops of rice and wheat leading to their major productions. Direct seeded rice is a potential resource conserving technology for enhancing productivity and profitability of farmers. In addition there is a need to take a re-look at the cropping pattern adopted by various states keeping in mind the way climate change is impacting major crops and sowing pattern. **Key words**- Integrated Farm Management, e-NAM, Sprinkler Irrigation, Drip Irrigation, Tower Irrigation.

ROLE OF METEOROLOGICAL FACTORS ON DEVELOPMENT OF CERCOSPORA LEAF SPOT DISEASE OF SESAME

C. S. CHOUDHARY, ANJANA ARUN¹, R. S. SINGH and MD MINNATULLAH

DR. RAJENDRA PRASAD CENTRAL AGRICULTURAL UNIVERSITY, PUSA, SAMASTIPUR, BIHAR, INDIA

¹DEPTT. OF PLANT PATHOLOGY, V. K. S. COLLEGE OF AGRICULTURE, DUMRAON, BUXAR (BIHAR)

Sesame (Sesamum indicum L.) is one of the important and ancient oilseed crop cultivated both in tropical and sub tropical regions. It is also named as gingelly, til or tila and used by us because of its considerable economic importance. It is called as "Queen of oil seed crops" by

virtue of the excellent quality of its sweet oil. The Cercospora leaf spot, caused by the fungus, *Cercospora sesame* Zimm, is one of the important disease of this crop which infects all above ground parts of the plant, resulting in complete defoliation and leads to severe economic losses that varies from 20 to 50 %. The disease appeared during 1st week of July in the field and its intensity increased gradually till harvest of the crop during the crop seasons. Maximum apparent infection rate was calculated at July 15, during both years of experimentations. The temperature, 23.93 to 31.75°C and 23.41 to 30.45°C, relative humidity 66.9 to 89.15% and 67.2 to 86.6%, rainfall 5.66 mm and 11.05 mm and 7 and 11 number of rainy days were favourable for maximum disease development during June 25 to July 15. Multiple regression equation between disease index and weather variables exhibited strong relationship among the different components of the epiphytotics during both the years ($R^2 = 0.989$ and 0.964) respectively.

Key words: Sesame, meteorological factors, leaf spot, Cercospora sesame.

EFFECT OF DIFFERENT HYDROPONIC SYSTEMS ON LEAFY VEGETABLES GROWTH, YIELD PERFORMANCE AND NUTRIENT AVAILABLE AT COLD ARID LADAKH REGION.

KAUSHAL KUMAR^{*}, SOMEN ACHARYA, NISHA SHARMA, VIVEK KUMAR TIWARI, NARENDRA SINGH AND O. P. CHAURASIA

DEFENCE INSTITUTE OF HIGH ALTITUDE RESEARCH (DIHAR), DRDO, C/O 56 APO, LEH-LADAKH, 194101.

"Ladakh" is a high altitude and is considered as one of most difficult terrain and highest battle field in the world. The temperature fall to -20 °c to -35 °c degree in winter. In order to meet the basic human requirements of fresh food in extreme high altitude condition. Thus, the region poses major challenges in fresh vegetables production throughout the year.Hydroponics is the technique of growing plants in soilless condition with their roots immersed in nutrient solution. This system helps to face the challenges of climate change and also helps in production system management for efficient utilization of natural resources especially in areas where soil and water are limiting factors for plant growth. Theresearch experiment was conducted during summer season of summer 2018 at the field of Vegetable Research Unit, Defence Institute of High Altitude Research, DRDO, Leh-Ladakh. The experimental site was fairly uniform and levelled green house. Different hydroponic system (Circulated and Non- Circulated) was designed for the cultivation of leafy vegetables. Three types of hydroponics system available Vertical-circulated (NFT), Horizontal-circulated (NFT) and Non-Circulated systems. Cultivation of spinach and lettuces by using different hydroponic systems was carried out under controlled atmosphere. Nutrient solution prepared with mixing 2.5 ml Hogland solution / 10 Litre water. pH 6-6.5 is a good for growing plant. So we maintained that pH for media solution. Every 15 days interval we replaced that media with same formulation and maintained pH as mentioned above. The basic prior need for growing plants in nutrient solution (Hydroponic unit) is availability of small seedling plants to be grown, therefore a small flat bed nursery has been raised in Green house. The seedling of leafy vegetables (Spinach and Lettuces) is suitable for transplanting in 25-35 days after sowing. Through proper management and almost care leafy vegetable will be ready for consuming in 4 to 6 weeks after transplant.

Different hydroponic systems viz. horizontal and vertical NFT and non-circulated systems were evaluated for growth and yield performance of lettuce and spinach. At vertical NFT System significant enhancement of plant height (30.3 cm); root length (28.1 cm); leaf area (90.4 cm²) of spinach was observed as compared to non- circulated systems. But for lettuce plant height was significantly higher (25.6 cm) in non-circulated systems as compared to vertical NFT (19.2 cm) probably due to closer spacing at non-circulated systems. Leaf chlorophyll and anthocyanin content was found higher in circulated NFT systems. The yields of leafy greens were recorded highest at vertical NFT systems (3.45 kg/m² for lettuce and 3.15 kg/m² for spinach respectively). Minimum yield was recorded at non-circulated system (2.12 Kg/m² for lettuce and 1.35 Kg/m² for spinach respectively) at time of harvesting. Accordingly the lettuce and spinach plant nutrient macro and micro available are showing significant at harvesting. Early harvesting was also achieved at NFT system as compared to non-circulated hydroponics system

Keywords: Hydroponics, NFT-Nutrient Film technique, Circulated and Non-Circulated system

INTEGRATED MANAGEMENT OF ROOT KNOT NEMATODE (M. GRAMINICOLA) IN RICE NURSERY

JASKARAN SINGH* KAMAL KHILARI, AND SANCHITA PAL

DEPARTMENT OF PLANT PATHOLOGY, SVP AGRI. AND TECH. UNIVERSITY MEERUT.

Rice (Orvza sativa L.) belongs to family Poaceae. It is the staple food in developing countries. China and India are two major rice producing country. In India, rice is growing in almost all the states. The root knot nematode, Meloidogyne graminicola and Meloidogyne triticoryzae, infecting rice and wheat also causing serious losses to rice crop in some areas in north India. This nematode is also widely distributed in Western Uttar Pradesh of India and causes economic damage to rice-wheat cropping systems. Nematodes that feed on roots and generally do not produce specific above-ground symptoms are also possible causal candidates for this decline. However, they are often neglected due to lack of conspicuous above-ground symptoms and knowledge of plant-parasitic nematodes. For management of root knot nematode, many practices such as chemical method, physical, biological and cultural practices, land management practices and growing resistant varieties have been reported. Integrated management of root knot nematode also a effective method for control the root knot nematode infestation in field condition in which used different practices alone and with combination viz. soil solarization, seed treatment with Trichoderma @ 5gm/kg of seed and carbofuran @ 0.3gm/kg of seed, soil application of Trichoderma isolate-13 @ 10 gm/m² and soil application of carbofuran @ 4gm /m² were evaluated for integrated management of against root knot nematode. It was observed that all the treatments significantly reduced the galls/plant in both experimental years in rice nursery. In both (2016 and 2017) experimental years, minimum 0.67 and 1.00 galls/plant were recorded in (Ts) Soil solarization + soil application of Trichoderma isolate-13 @10gm/m² followed by 1.33 and 1.67 galls/plant in (T₉) Soil solarization + soil application of carbofuran @ 4gm/m². Average (3.33 & 3.00 galls/plant) were recorded in (T₄) Soil solarization + seed treatment with *Trichoderma* @ 5gm/kg of seed and (4.00 & 3.44 galls/plant) in (T₅) Soil solarization + seed treatment with carbofuran @ 0.3 gm/kg of seed. In comparison to treatments average (17.11 &18.78 galls/plant) were recorded in untreated control. It clearly indicates that Soil solarization + soil application of Trichoderma isolate-13 may act as an effective for the management of rice root knot nematode in integrated nematode management programme. Key words: Trichoderma, soil solarization and carbofuran.

TRANSGENIC PLANTS AND THEIR APPLICATIONS

JYOTI KAUSHIK

DEPARTMENT OF GENETICS AND PLANT BREEDING, CHAUDHARY CHARAN SINGH HARYANA AGRICULTURAL UNIVERSITY, HISAR (HARYANA)-125001

Genetic engineering is known as one of the most important tools for crop improvement and producing highly useful varieties. For this, it is necessary to manipulate the characteristics of plants. This can be done with transferring foreign gene from unrelated source to a known source which may be a crop or a variety or anything that are useful for mankind. Transgenic plants contain transgene in its genome from a related or unrelated source. There are many methods by which a transgene can be transfer from one source to other and these methods can be categorized in direct and indirect gene transfer method. Indirect gene transfer method includes plasmid of a bacterium, *Agrobacterium tumefaciens* while direct gene transfer method includes, chemical mediated, microinjection, lipofection *etc.* Transgenic plants have significant potential in the bio-production of therapeutic agents because of ease in genetic manipulations, lack of potential contamination, low cost of biomass production, short time duration of production *etc.* Golden rice is one of the best example of transgenic plants. Differences in codon usage between plants and prokaryotes can lead to inefficient expression of prokaryotic protein in plants. Some plants may produce compounds which may be allergic.

Keywords: transgenic, agrobacterium, transgene, codon

INTEGRATED WEED MANAGEMENT IN SUMMER GROUNDNUT (Arachis hypogaea L.) D.V. THORAT, A. A. CHOTHE and G. B. SURYAVANSHI

DEPARTMENT OF AGRONOMY, RCSM COLLEGE OF AGRICULTURE, KOLHAPUR, (MH) 416004

A field experiment was conducted during summer season of 2018 at Agronomy Research farm, RCSM college of Agriculture, Kolhapur-416004, Maharashtra, (India), to find out the effect of different weed management practices on summer groundnut in Kolhapur with combination of 8 weed management treatments in three replications. Weed free check recorded lowest dicot and monocot weed population at 75 DAS (6.04 and 7.91) and at harvest (8.20 and 7.19), lowest weed dry matter (9.62 gm⁻²) and highest pod yield (37.10), haulm yield (55.65), No. of pods plant⁻¹(32.72), Wt. of pods plant⁻¹(23.34 g), No. of nodules plant⁻¹(61.67), Wt. of nodules plant⁻¹(1.23 gm) and SMK percentage (81.78) which is at par with the treatments pre-emergence application of pendimethalin @ 1 kg a.i ha⁻¹ + 1 HW at 30 DAS (7.58 and 9.04, 8.28 and 9.08, 11.45 gm⁻², 36.45, 54.67, 30.60, 22.05, 59.33, 1.19 gm,80.51, respectively) and Pre-emergence application of pendimethalin @ 1 kg a.i ha⁻¹ + 1 hoeing at 30 DAS(7.98 and 9.50, 8.36 and 9.51, 11.64 gm⁻², 35.82, 53.73, 30.37, 20.95, 57.30, 1.15 g, 80.43, respectively). Based on economics highest gross monetory returns, Net monetory returns and B:C ratio was recorded by treatment pre-emergence application of pendimethalin @ 1 kg a.i ha⁻¹ + 1 HW at 30 DAS (163755 Rs ha⁻¹, 103922 Rs ha⁻¹ and 2.73) which is comparable with treatment Pre-emergence application of pendimethalin @ 1 kg a.i ha⁻¹ + 1 hoeing at 30 DAS. **Key word:**- Pendimethalin, Quizalofop-p-ethyl,

STUDIES ON PREPARATION AND EVALUATION OF LOW CALORIE POMEGRANATE PLUM NETOR KANCHAN N. LENGURE, ASHWINI A. CHOTHE DEPARTMENT OF FOOD MICROBIOLOGY & SAFETY, DEPARTMENT OF POST-HARVEST TECHNOLOGY COLLEGE OF FOOD TECHNOLOGY, NASHIK (MH)422003

COLLEGE OF HORTICULTURE, NASHIK(MH)422003

Nectar is a non-fermented beverage, formulated using the juice or pulp of one or more fruits, water in certain concentration resulting in the product of ready to drink product. We were select pomegranate and plum and ginger for preparation of nectar because its nutritional value is so high and it gives many medicinal uses. Studies were conducted of Pomo-Plum blended Nectar with sugar syrup, for their Physicochemical and shelf life studies. Pomegranate juice was blended with Plum and ginger juice in different proportion. i.e. S1 (50% pomegranate juice, 48 % plum juice, 2% & ginger juice); S2 (70% pomegranate juice, 29 % plum juice, 1 % & ginger juice); S3 (60% pomegranate juice, 38% plum juice, 2% & ginger juice) low calorie pomo plum necter (health drink) was developed using the extracts of spices, mint, ginger, salt and non-nutritive sweeteners at different sweetness proportions at optimum fruit constituents without compromising sensory qualities. The development efforts had successfully reduced calorie value of appetizers up to 10 per cent per serving with saccharin and cyclamate at 20 per cent sweetness level. The physico-chemical and organoleptic characteristics were recorded at different intervals during storage period of 180 days under ambient conditions. During storage there was an increase in total soluble solids, reducing sugars & pH and decrease in titratable acidity, total sugars, ascorbic acid and vitamins. Despite the changes observed in various physico-chemical, sensory and microbial attributes, the over view of quality parameters of appetizers remained acceptable. Cost of production of low calorie pomo- plum nector having similar quality and sensory attributes with saccharin and cyclamate.Pomo-Plum blended Nectar was prepared by using preservative sodium benzoate, water, and sugar and fruit juice. By adding preservative and by packaging in glass bottle at refrigeration and ambient temperature, it increases the shelf life of Pomo-Plum blended Nectar. Pomegranate and plum are the fruits which have good nutritional value. Energy value (Kcal) 60Vitamin C (mg) 1.3 TSS (0Brix) 15 Acidity (%) 0.3 pH 3.3. Organoleptic evaluation showed that Pomo-Plum blended Nectar(S2) prepared by using the 70% pomegranate juice, 29 % plum juice, 1 % & ginger juice was found to be more acceptable as compared to sample S1 and S3 as it gave good colour, flavor, aroma, taste, mouth feel and overall acceptability. Pomo-Plum blended Nectar packaged and stored at the refrigeration temperature of retained the desired quality attributes in nectar better than nectar stored at ambient temperature. Glass bottles gave greater protection against degradation of the chemical attributes of the Pomo-Plum blended Nectar.

THE EFFECT OF SULPHUR AND ZINC ON YIELD AND YIELD ATTRIBUTING CHARACTERISTICS OF LINSEED CROP DIVYA DIWAN , AJAY KUMAR AGRAHARI

DEPARTMENT OF SOIL SCIENCE, MAHATMA GANDHI CHITRAKOOT GRAMODYA VISHWAVIDYALYA, CHITRAKOOT

A field experiment was conducted during rabi season 2017-18 at rajoula agriculture farm of Mahatma Gandhi Chitrakoot Vishwavidyalya, Chitrakoot satna (MP) to assess the effect of different level of sulphur and zinc on yield of Rabi Linseed. The experiment comprised three level of sulphur (0%, 0.5%, 1%), Zinc (0 kg/ha, 5 kg/ha, 7.5kg/ha) laid out in factorial Randomized block design with three replication.

Cultivar Shekhar was used as the test crop. The result revealed that all these mentioned parameter were significantly affected by the addition of sulphur and Zinc doses. Highest seed yield 3.5 q/ha and 3.38q/hac were obtained when S (0.5%) and Zn (7.5kg/ha) were applied. The highest yield 4.4q/hac and the yield attributes viz. Plant height (51cm), branches/plant (4.83), capsules/plant (25.33), seed/capsules (8.16), 1000 seed weight (9.30) were also obtained for the treatment combination of 0.5% S and thereafter decreases 1% S level. Therefore, It was conducted that application of 0.5% S and 7.5 kg/hac Zn should be used for improvement of yield and yield attributing characteristic of linseed crop.

Keyword: Yield, yield attributing character, linseed, zinc, sulphur.

PATH ANALYSIS FOR QUANTITATIVE AND QUALITATIVE TRAITS IN BRINJAL (SOLANUM MELONGENA L.)

JYOTI P JIRANKALI^{1*}, GANGAPRASAD S¹, UPASANA MOHAPATRA², MANOHARA S N¹, AND NIKHILA³ ¹DEPARTMENT OF GENETICS AND PLANT BREEDING, UAHS, SHIVAMOGGA ²DEPARTMENT OF PLANT BIOTECHNOLOGY, UAS, GKVK, BENGALURU ³DEPARTMENT OF GENETICS AND PLANT BREEDING, UAS, DHARWAD

Among the 19 traits chosen for path analysis at phenotypic level viz, fruit weight followed by number of fruits per plant, number of primary branches, number of fruits per cluster, fruit length, days to 50 % flowering, fruit length/diameter ration, fruit diameter had positive direct effect indicating their true positive and significant association with yield. Therefore, direct selection for these traits would be rewarding for improvement of yield. Path analysis studies revealed significant positive association at phenotypic level among the traits viz., fruit weight followed by number of primary branches (0.4851), fruit length (0.4161), number of fruits per cluster (0.3348), fruit diameter (0.2787) had exhibited true association with direct effect on yield per plant. The direct selection for these traits would be rewarding for improvement in the total yield per plant. Among the 19 traits chosen for path analysis at phenotypic level viz., fruit weight (0.4161), days to 50 percent flowering (0.1259), fruit length/diameter ration (0.1147), fruit diameter (0.1102) had positive direct effect indicating their true positive and significant association with yield. Therefore, direct selection for these traits would be rewarding for improvement of yield.

Key words: Path analysis, phenotypic level, positive association.

ECONOMIC STUDY ON FARM MECHANIZATION AND POST-HARVEST- TECHNOLOGIES TO ENHANCE FARM PROFITABILITY

DRONAK KUMAR¹, NARESH KUMAR²

DEPARTMENT OF AGRICULTURAL ECONOMICS, INDIRA GANDHI KRISHI VISHWAVIDYALAYA, RAIPUR.

The effective mechanization contributes to increase production in two major ways: firstly the timeliness of operation and secondly the good quality of work. The requirement of power for certain operations like seedbed preparation, cultivation and harvesting becomes so great that the existing human and animal power in the country appears to be inadequate. They see mechanization as a means for achieving their objectives. In spite of the limitations with which they exist, their performance has been note worthy. There is a positive correlation between application of improved technologies and the land productivity. Post-harvest technology is inter-disciplinary "Science and Technique" applied to agricultural produce after harvest for its protection, conservation, processing, packaging, distribution, marketing, and utilization to meet the food and nutritional requirements of the people in relation to their needs. The post-harvest technologies which are appropriate to the condition of the area and crop grown. These technologies serve twin purpose; the increased shelf-life of the product and enhancing accessibility to niche markets which offers higher prices. The post-harvest assessments pointed to poor temperature management and poor quality packaging as the main sources of losses and quality problems, focus during field trials was on simple technologies that could reduce temperature or improve the quality of packages. We were also interested in technologies that could protect against insect damage, control decay, or help to reduce losses by adding value.

EFFECT OF DIFFERENT DATE OF SOWING AND APPLICATION OF SELECTIVE INCETCTICIDES AGAINST ON POPULATION DYNAMICS OF MUSTARD APHIDS IN MUSTURD CROP (*BRASSICA JUNCEA*) UNDER CLIMATE CONDITION OF ALLAHABAD

JYOTISH KUMAR SAHU¹, YOGESHWAR PRASAD SAHU², ANOSH GRAHAM³, SOHAM SAHOO⁴

COLLEGE OF FORESTRY, SAM HIGGINBOTTOM UNIVERSITY OF AGRICULTURE, TECHNOLOGY & SCIENCES, ALLAHABAD 211007 (UTTER PRADESH) INDIA.

A Field experiments were conducted at College of forestry, Sam Higginbottom University of Agriculture, Technology & Sciences Allahabad during the Rabi season on - October 2016 to March 2017. To study the effect of different sowing dates and application of pest insecticides on population dynamics of mustard aphids in mustard crop. the effective of two insecticides viz. chlorpyrifas and imidacloprid against mustard aphid. The mustard plant were sprayed with the insecticides at 75 and 110 days after sowing. the mortality of mustard aphid was assessed at after first and second spraying of insecticides chlorpyrifas showed the most effectiveness insecticides among the causing the highest mortality of mustard aphid followed by imidacloprid.

Keywords - Mustard Aphid, Spray Insecticides, Effectiveness Insecticides.

EFFECT OF FOLIAR APPLICATION OF FE, ZN AND SEED TREATMENT WITH MO ON GROWTH, YIELD, AND UPTAKE OF NUTRIENTS IN SOYBEAN UNDER VERTISOL.

G. R. HANWATE, S. N GIRI. AND SARIKA NARALE

DEPARTMENT OF SOIL SCIENCE AND AGRICULTURAL CHEMISTRY COLLEGE OF AGRICULTURE, BADNAPUR, V.N.M.K.V., PARBHANI 431 401 (M.S), INDIA

A field experiment was conducted during the year 2017-18 at college of Agriculture, Badnapur with aim to study the effect of seed fortification with Mo and foliar application of Zn and Fe on growth, yield and uptake of nutrient at critical growth stages of soybean crop. The experiment is comprised of nine treatments and was fitted in RBD. The treatments were seed fortification of Mo along with foliar application Zn and Fe alone and in different combination. The foliar application Zn and Fe @ of 0.5% was undertaken at 30, 50 and 70 days after sowing. The results emerged out from this study indicated that the Significantly highest amount of chlorophyll content 26.66 mg per 100g plant, highest number of nodules 51.33, highest number of branches (14.26 plant⁻¹) and maximum dry matter yield i.e. 11.28, 17.96 and 23.02 g plant⁻¹ were recorded at flowering, pod formation and at harvest stages of soybean with application of treatment T₉ which received RDF along with seed fortification of Mo and foliar application Zn and Fe which was followed by treatment T₇ and T₆. Significant and maximum nutrient uptake i.e. 174.18, 181.55 and 186.39 kg N ha⁻¹, 16.84, 17.81 and 19.23 kg P ha⁻¹, 128.17, 134.35 and 141.13 kg K ha⁻¹ and 18.96, 21.12 and 24.34 kg S ha⁻¹ were recorded at flowering, pod formation and at harvesting stages of soybean crop with administration of treatment T9. Similarly significant and maximum grain yield 2247.60 Kg ha⁻¹and straw yield observed (2666.30 kg ha⁻¹) in T9. However lowest values were recorded in control (T₁).

Keywords: Foliar applications, seed fortification, Zn, Fe and Mo, Vertisol

CHARACTERIZATION OF SOILS OF JHUMPA KALAN WATERSHED OF BHIWANI DISTRICT HARYANA, NORTH-WEST INDIA

JYOTIRMAYA SAHOO1*, DINESH TOMAR², MD BASIT RAZA¹

¹DIVISION OF SOIL SCIENCE AND AGRICULTURAL CHEMISTRY, ICAR-INDIAN AGRICULTURAL RESEARCH INSTITUTE, NEW DELHI-110012.

²DEPARTMENT OF SOIL SCIENCE, CCS HARYANA AGRICULTURAL UNIVERSITY, HISAR-125004

Our aim of optimizing the utilization of watershed resources with intensification of agriculture resulted either in the fast depletion of nutrients or occasionally in their accumulation. Thus, characterization of Jhumpa Kalan watershed of Bhiwani district Haryana was done and the morpho-physical and chemical characteristics were investigated in the watershed area. Visual interpretation of IRS-P6 satellite imagery (FCC) of 1:50000 was used for the preparation of base map of the area. Eight representative pedons of micro watersheds *viz.*, four near to IWMP Motipura (P1), Sainiwas (P3), Jhumpa (P5) and Budhsheli (P7) and four few kms away from IWMP Motipura (P2), Sainiwas (P4), Jhumpa (P6) and Budhsheli (P8) were selected. Results indicated that soils of micro watersheds pedons varied in colour from dark brown to dark yellowish brown with sand to loamy sand texture along with higher sand content as compared to silt and clay. These soils were found slightly to moderately alkaline in reaction and non-saline. Bulk density, available water content, organic carbon (OC), cation exchange capacity (CEC) and base saturation varied from 1.38 to 1.62 Mg m⁻³, 2.04 to 13.78 %, 0.06 to 0.27 %, 2.21 to 7.85 cmol (p⁺) kg⁻¹ and 88.36 to 98.57%, respectively.

Keywords: Characterisation, watershed, pedon, texture, satellite imagery

COMPOST AND ITS ROLE IN AGRICULTURE

KAVITA AND SEEMA

DEPARTMENT OF SOIL SCIENCE, CCS HARYANA AGRICULTURAL UNIVERSITY, HISAR 125004

Composting is eco-friendly and most effective means of recycling of organic waste, leading to a stabilized final product, free from pathogens that can be used as a fertilizer. Good quality compost having positive impact on soil health help in replenishing soil nutrient and optimum soil moisture content. Compost is beneficial to plants because as it is rich of nutrients and also act as soil conditioner. Composting of organic waste having advantage over direct application because it eliminates the pathogens and weeds, reduce volume of the organic waste, controls the odours, easy to store, transport and use. The benefits of application of compost divided into two groups: improve the crop productivity and profitability and improve the soil quality or soil health. In order to ensure safe application of compost, the standards laid down on the recommendation of Bureau of Indian Standard (BIS) in 2013. Acc. to these standards compost prepared from municipal solid waste having maximum bulk density should be 1.00, Arsenic (10.00 mg/kg), Cadmium (5.00 mg/kg), Chromium (50.00 mg/kg), Mercury (0.15 mg/kg) and Zinc (100.00 mg/kg) on basis of dry mass. EC of compost should be less than 4 dsm⁻¹. The pH should be neutral or within the range of 6.5 to 7.5. The compost should neither be completely dry nor be lumpy and moisture by mass 25%. The Nitrogen, Phosphorous and Potassium contents should be 0.8, 0.4 and 0.4% respectively. The Nitrogen should be in the form of Nitrates. The C/N ratio should be in between 15 to 20:1. Minimum total organic carbon by total dry mass should be 40%. As compost comes under the category of bulky organic manure its application to soil in large amount. This demerit of compost can be overcome by enrichment of compost, it is recommended that compost with a C/N ratio of about 20:1 should be treated with ammonium sulphate or urea so as to bring the C/N ratio to <10:1 and N content >2.5%, phosphorous enriched compost can be prepared by adding 5% super phosphates, dicalcium phosphates and rock phosphates at the time of filling of compost pits and this could raise the phosphorous content up to 5%. Key words: Compost, Benefits of composting, Quality parameters, Enriched compost

COMBINING ABILITY STUDIES IN GREENGRAM (Vigna radiata (L.) WILCZEK) KOHAKADE S. N ; KUTE N.S ; KARWAR S.

DEPARTME N T OF AGRICULTURAL BOTANY M.P.K.V;RAHURI

The present investigation was carried out with a view to study the magnitude of combining ability through half diallel analysis excluding reciprocals involving seven parents and their twenty one F1 in green gram for kharif 2018-19 condition. The experimental material was planted in randomized block design with three replications at PGI,Farm of M.P.K.V. Rahuri . The analysis of variance for all the characters revealed that parents were found to be highly significant for all the character studied except number of primary branches were significant at 5% level and hybrids were highly significant for all the characters, indicating presence of considerable amount of genetic variability in the parental material tested. Parents vs. hybrids comparison was found to be highly significant for all the characters for seed yield per plant. Combining ability analysis revealed that the mean squares due to general combining ability and specific combining ability were highly significant for all the characters.

However, the variances due to general combining ability were lower than specific combining ability for days to maturity, plant height, number of branches per plant, number of cluster per plant, pods per clusters, pods per plant, pod length, number of seeds per pod, seed yield per plant and per plot, thus on the basis of ratio of §²gca and §²sca results pointing out the preponderance of non-additive gene effects for the characters studied. The general combining ability effects revealed that Phule-M-402-1 and Utkarsha were the good general combiner for seed yield and also good general combiner for most of the characters except number of pods per cluster. The crosses Utkarsha x TM-96-2, Phule-M-402-1 x BPMR-2003-2, were found to be good in respect of sca effects for grain yield per plant.

EFFECT OF RED ROT DISEASE OF SUGARCANE ON DIFFERENT CANE PARAMETERS

MD. MINNATULLAH¹, C.S. CHOUDHARY² AND SHIVA PUJAN SINGH³ SUGARCANE RESEARCH INSTITUTE, RPCAU, PUSA, SAMASTIPUR ¹DEPARTMENT OF PLANT PATHOLOGY, SRI, PUSA ²DEPARTMENT OF PLANT PATHOLOGY, TCA, DHOLI ³DEPARTMENT OF AGRIL. ECONOMICS, SRI, PUSA

Sugarcane is an important agro-industrial crop grown mainly for sugar production in India and contributes in agriculture and industrial economy of country. In Bihar condition, combined effects of several abiotic as well as biotic stresses limits the production and productivity of sugarcane. Out of different biotic stresses, red rot disease of sugarcane caused by *Colletotrichum falcatum* Went. is the most serious and destructive disease among all the diseases occurring in Bihar. It causes high losses to farmers as well as sugar mills by deteriorating the juice quality and overall production of sugarcane. The extent of reduction in qualitative as well as quantitative parameters of sugarcane varied according to the level of resistance of varieties and the level of virulence of the pathogen. Therefore, the present investigation was worked out to study the effect of red rot disease on different cane parameters. In response to red rot infection a decline in sett germination, cane length, cane girth, cane weight, sucrose, brix and purity were observed. The maximum (35.0%) in sett germination, (21.5%) cane length, (32.2%) girth, (42.2%) cane weight, (26.2%) sucrose, (15.8%) brix, while, (17.5%) decline in purity respectively was observed in variety CoSe 92423. While, minimum reduction (14.0%) in germination, (12.6%) length, (9.5%) girth, (14.4%) weight, (16.0%) sucrose, (7.2%) brix and (13.0%) in purity respectively was observed in variety CoP 11436.

Key word: Sugarcane, Red rot, disease, cane parameters

EFFECT OF GERMINATION MEDIA ON SEED GERMINATION OF CEIBA PENTENDRA (L.)

MOHIT HUSAIN^{*}, MANMOHAN J. DOBRIYAL, V.M. PRAJAPATI, AND JILARIYA DEVANAND DEPT. OF SILVICULTURE & AGROFORESTRY, COF, ACHF, NAU, NAVSARI, GUJARAT-396 450

An experiment was conducted in the nursery of College of Forestry, ACHF, NAU, Navsari, Gujarat during July, 2019. Freshly collected seeds of Silk cotton tree (*Ceiba pentendra*) were sown in the sand bed after normal water pre treatment of soaking one hour in different germination media. Results revealed that germination was started after 5 days of seed sowing. After 10 days of sowing it was observed that seed germination reached to peak (100 per cent) in sand media meanwhile in cocopit and soil media it reached to 95 and 93 per cent at 14 and 15 days respectively. Thus, result suggests that sand medium is a good germination media for seed germination of *Ceiba pentendra* in the nursery.

Keywords: Ceiba pentendra, germination, treatments, nursery.

EFFECT OF DIFFERENT WEED MANAGEMENT PRACTICES ON ONION (ALLIUM CEPA L.)

MANJU RANI SAHU^{*1}, ASHIRBACHAN MAHAPATRA² AND MADAN KUMAR JHA³ DEPARTMENT OF VEGETABLE SCIENCE IGKV, RAIPUR (C.G.) DEPARTMENT OF AGRONOMY IGKV, RAIPUR (C.G.)

DEPARTMENT OF VEGETABLE SCIENCE IGKV, RAIPUR (C.G.)

The field experiment was conducted during Rabi season of 2016-17 at the Horticulture Research cum Instructional farm, BTC CARS, Bilaspur (C.G.). The treatments consisted of ten combination of different agro input management practices viz., T1 (control weedy check),T2 (weed free),T3 (Pendimethalin @ 1.75 kg/ha (pre-emergence)),T4 (Oxyfluorfen @ 1 kg/ha (pre-emergence)), T5 (Quizalofop-ethyl @1 kg/ha (Post-emergence)), T6 (Pendimethalin @ 1.750 kg/ha (Pre emergence) + Quizalofop-ethyl @ 1 kg/ha (Post-emergence)), T6 (Pendimethalin @ 1.750 kg/ha (Pre emergence) + Quizalofop-ethyl @ 1 kg/ha (Post-emergence)), T7 (Oxyfluorfen @ 1 kg/ha (Pre-emergence)) + Quizalofop-ethyl @ 1 kg/ha (Post-emergence)), T8 (Two hand weeding at 25 and 45 DAT), T9 (Black polythene mulch), T10 (Organic mulch with paddy straw @ 20 q/ha). The weed population weed fresh weight and weed dry matter, varied significantly with all the stages of crop. It showed increasing trend with lowest at 20 DAT and highest at 60 DAT. Conidering the weed control strategies significantly lower weed population. Weed fresh weight, weed dry matter, weed index and relatively higher weed control efficiency were recorded in weed free plot (T2) then rest of all the treatments and in herbicidal treatments T7 (Oxyfluorfen @ 1 kg/ha (Pre-emergence) + Quizalofop-ethyl @ 1 kg/ha (Postemergence)), was attribute to the effective control of weeds and in terms of alone apploication of herbicide Oxyfluorfen @ 1 kg/ha (pre-emergence)), was attribute to the effectively than other treatments. **Keywords**: Pendimethalin, Oxyfluorfen, Quizalofop-ethyl, and onion

ARBUSCULAR MYCORRHIZAL FUNGI (AMF) IN THE ALLEVIATION OF SALINITY STRESS OF MUNGBEAN [VIGNA RADIATA (L.) WILCZEK]

MOUSHREE SARKAR*, SUVRO GHOSH AND SABYASACHI KUNDAGRAMI

DEPARTMENT OF GENETICS AND PLANT BREEDING, INSTITUTE OF AGRICULTURAL SCIENCE, UNIVERSITY OF CALCUTTA, KOLKATA-700019, WEST BENGAL, INDIA

Mungbean, an important protein rich food legume, is suffering from different stresses causing alarming yield depression. Salinity stress remains a chronic threat to its yield in India, where ground water extensively used in agriculture causing unprecedented salt accumulation.

Arbuscular mycorrhizal fungi (AMF) play a major role which influence plant growth, nutrient uptake and contributes to ecosystem processes. The present study aims, to demonstrate the impact of AMF (*Glomus mosseae*) on physio-biochemical attributes of mungbean exposed to salinity. Two highly tolerant, two moderately susceptible and two highly susceptible germplasms were screened from fifty high yielding early maturing germplasms and were subjected to salinity stress (300mM NaCl) alone and in presence of AMF (approx. 100 spores/g soil) under greenhouse. Results revealed that AMF alleviates the salinity related growth reduction by improving the nutrient uptake and by balancing the ratio between K:Na and Ca:Na which impact directly the osmoregulation of the plants. Growth parameters, photosynthetic efficiency and chlorophyll content were also enhanced in presence of AMF. Mycorrhiza inoculation also increased the proline content (23%), water-use efficiency (38%) and activity of different antioxidant enzymes in significant manner providing efficient protection against salinity. All these positive impacts of AMF were duly reflected in significant increase of grain yield (more than 2 fold increase) in mungbean. Interestingly, salinity stress induced retarded growth and decline in other biochemical parameters in susceptibles recorded remarkable recovery following AMF inoculation. The colonization of AMF appears to be a practical eco-friendly approach to attenuate the adverse effects of salinity on the growth and productivity of mungbean.

Key words: Arbuscular mycorrhizal fungi (AMF), mungbean, physio-biochemical attributes, salinity.

INDUCTION OF MUTATION IN *TRICHODERMA* STRAINS (TH 14 AND TH 3) FOR ENHANCING COMPATIBILITY WITH HIGHER CONCENTRATIONS OF FUNGICIDES *VIZ*. THIOPHANATE METHYL AND PROPICONAZOLE

MEENAKSHI DWIVEDI¹, A. K. TEWARI² AND KARUNA VISHUNAVAT²

¹DEPARTMENT OF PLANT PATHOLOGY, SUGARCANE RESEARCH INSTITUTE, RPCAU, PUSA, SAMASTIPUR, BIHAR ²DEPARTMENT OF PLANT PATHOLOGY, G. B. PANT UNIVERSITY OF AGRICULTURE AND TECHNOLOGY, PANTNAGAR, UTTARAKHAND

Biocontrol agents need to be tolerant to chemical pesticides, which is imperative for their efficient application in integrated pest management (IPM). Mutation has been proven as a reliable technique to develop pesticide resistant strains of biological control agents. Hence, under this experiment Trichoderma strains (Th 14 and Th 3) were subjected to chemical and physical mutagenesis with the intention to isolate mutants having enhanced compatibility with higher concentrations of the fungicides, *i.e.* thiophanate methyl and propiconazole. The strains were exposed to three (03) novel combinations mutagens. In combination 1, the strains were exposed to ethyl methanesulphonate (EMS) @ 40 µl ml⁻¹ conidial suspension and subsequently irradiated with UV rays for 20 and 40 minutes. In combination 2, different concentrations of conidial suspensions of the strains viz. 0.5 ml, 0.75 ml and 1 ml were exposed to EMS (40µl), separately, followed by irradiation with UV rays for 30 minutes. In combination 3, the strains were exposed to gamma radiations @ 20, 25, 30, 40, 50, 60 and 65 k rad for 7, 9, 11, 15, 18, 22 and 24 seconds, followed by exposure to EMS @ 40μ l ml⁻¹ conidial suspension. Simultaneously, aliquot (100µ1) from each of the treated samples was poured onto plates seeded with PDA medium poisoned with 50, 100, 150, 200, 500 and 1000 µg ml⁻¹ of the two fungicides. The colonies obtained were sub-cultured on un-amended PDA medium. For stabilization of tolerance against the fungicides, the obtained colonies were repeatedly cultured on amended and un-amended medium. The colonies were intensively screened on the basis of their ability to tolerate repeated exposure to the fungicides. Resultantly, 08 mutants were obtained, 02 derived from strain Th 14, and 06 derived from strain Th 3, Among them was mutant Th 3 M1 that could tolerate propiconazole @ 1000 µg ml⁻¹. There has not been any report of such kind so far. Hence, present study is the first attempt in this direction. Mutant Th 3 M1 developed from Trichoderma harzianum (Th 3) could prove to be very crucial biocontrol component in integrated disease management strategies.

Key words: Trichoderma, mutation, fungicide tolerance

EFFECT OF PLANT GROWTH REGULATORS AND THIOUREA ON GROWTH AND YIELD OF BOTTLE GOURD [LEGENARIA SICERARIA (MOL.)STANDL] CV.PUSA NAVEEN MANISH KUMAR^{*1}, RISHABH DUBEY² AMD MADAN JHA³

¹NATIONAL SEED CORPORATION, BILASPUR (C.G)

^{2,3}DEPARTMENT OF VEGETABLE SCIENCE IGKV, RAIPUR (C.G)

The effect of plant growth regulators and thiourea on growth and yield of bottle gourd an experiment was conducted during kharif Season 2016 at the instructional farm mjrp college of agriculture and research jaipur (raj.). The experiment consisting 13 treatment (NAA 150,200 and 250 ppm. CCC 100,200 and 300 ppm. Thiourea 200, 500 and 700 ppm and control were replicated three time in a randomized block design keeping plot size of 6mx3m. The seed sowing was done on 11 july 2016 in the furrow spaced at 2.5m apart maintaining a plant to plant distance of 0.75m. The application of plant growth regulators and thiourea singnificant effect the vegetative as well as reproductive attribute of the crop. The exogenous application of NAA 250 ppm (T₃) recorded maximum vine length (6.70 m), nodes per vine (23.15) and leaf area (264.50 cm²). The CCC 300 ppm (T₉) treatment produced maximum primary (20.95) and secondary branches (9.36) per vine but minimum vine length (4.33),nodes per vine (18.05) and leaf area (218.36 cm²) were observed in this treatment. The maximum net return (Rs.204440 per hectare) and bic ratio (2.76) were recorded under ethrel 400 ppm.

Key words: Bottel gourd, PGR and Growth

DIFFERENTIAL EFFECTS OF PARENTAL EDUCATION AND OCCUPATION ON IDENTITY DEVELOPMENT OF DHARWAD PUC STUDENTS

MANEESHA BHATT AND LATA PUJAR

DEPARTMENT OF HUMAN DEVELOPMENT AND FAMILY STUDIES, COLLEGE OF COMMUNITY SCIENCE, UNIVERSITY OF AGRICULTURAL SCIENCES, DHARWAD - 580005, KARNATAKA, INDIA

A firmly established identity serves as a compass to navigate the course of life beyond adolescence by providing a sense of uniqueness to an individual and by promoting positive development. With this background, present study was conducted on urban and rural PUC students in the age group of 16-18 years who were randomly selected from four science coaching institutes of Dharwad taluk. Random selection of 10 to 15 per cent students from each class (PUC-I and PUC-II) of science coaching institutes was done that included an overall 312 PUC

students. Rural samples comprised of those students, who had completed their school education till Class-10th in their village and had come for PUC studies in coaching institutes of Dharwad located in urban area. Differential and correlational research designs were used to know the difference and relationship between identity development of PUC students and their parents education and occupation. Dimension of identity development scale was used to assess identity development of PUC students and general information schedule was used to gather basic information s of respondents. Chi-square and ANOVA were used for statistical analysis. Results of the study revealed that, father's education and occupation was not significantly associated with identity development of urban and rural PUC students but mother's education was significantly associated and differed with identity development of urban PUC students. Mother's occupation was also significantly associated and differed with identity development of PUC students. Thus, there is a need to invest more on quality education of parents which can mitigate poor identity development of PUC students. **Keywords**: Parents education, parents occupation, identity development and PUC students.

IMPACT OF HEAVY METALS ON PLANTS AND ANIMALS

KANCHAN AWASTHI AND MADHU PRASKASH SRIVASTAVA DEPARTMENT OF BOTANY, MAHARISHI UNIVERSITY OF INFORMATION TECHNOLOGY, LUCKNOW

Metal contamination issues are becoming increasingly common in India and elsewhere, with many documented cases of metal toxic ity in mining industries, foundries, smelters, coal-burning power plants and agriculture. Heavy metals, such as cadmium, copper, lead, chromium and mercury are major environmental pollutants, particularly in areas with high anthropogenic pressure. Heavy metal accumulation in soils is of concern in agricultural production due to the adverse effects on food safety and marketability, crop growth due to phytotoxicity, and environmental health of soil organism's Metal toxicity has high impact and relevance to plants and consequently it affects the ecosystem, where the plants form an integral component. Plants growing in metal-polluted sites exhibit altered metabolism, growth reduction, lower biomass production and metal accumulation. Various physiological and biochemical processes in plants are affected by metals. The contemporary investigations into toxicity and tolerance in metal-stressed plants are prompted by the growing metal pollution in the environment. A few metals, including copper, manganese, cobalt, zinc and chromium are, however, essential to plant metabolism in trace amounts. It is only when metals are present in bio available forms and at excessive levels; they have the potential to become toxic to plants. Worldwide, breast cancer is the most common malignancy that affects women .In Egypt, the incidence attained about 37.5% of total cancer cases among Egyptian females and is considered the fourth cause of death. Over the past decades, there has been a significant continuous increase in breast cancer rates.

Key word: Heavy Metals, Plants and Animals, Physiological and Biochemical Processes

USES OF ADENOCALYMMA ALLIACEUM MIERS PLANT EXTRACT TO CONTROL POSTHARVEST DISEASES

MADHU PRASKASH SRIVASTAVA AND KANCHAN AWASTHI

DEPARTMENT OF BOTANY, MAHARISHI UNIVERSITY OF INFORMATION TECHNOLOGY, LUCKNOW

In the development of strategies for post harvest disease control, it is imperative to take a step back and consider the production and postharvest handling systems in their entirety. Many preharvest factors directly and indirectly influence the development of postharvest disease, even in the case of infections initiated after harvest. Traditionally fungicides have played a central role in postharvest disease control. However, trends towards reduced chemical usage in horticulture are forcing the development of new strategies. Aqueous extract from the leaves of garlic creeper (*Adenocalymma alliaceum* Miers.) was investigated for their antifungal activity against towards *Alternaria spp., Aspergillus spp., Penicilium* spp., *Sclerotinia spp., Fusarium spp..*. It has shown strong reducing effect on the development these pathogens with various mechanisms of antagonistic influence. The extract demonstrated wide spectrum fungitoxicty. The methanolic extract of *Adenocalymma alliaceum* leaves showed an antimicrobial activity against *Alternaria spp.* and *Penicilium spp.* This medicinal plant can be used for the remedy of infectious diseases caused by pathogenic fungi. Exposure of the spores of test fungi to the extract for 5 h inhibited the spore germination by 75-85%, after exposure for 10 h, a 100% inhibition was observed. However, the inhibitory activity of the extract decreased to 70 % when boiled for 6 min and was completely lost after boiling for 10 min. Moreover, the results agree with the use of *Adenocalymma alliaceum spp.* in postharvest loss treatment because of Antifungal activity on *Fusarium spp* and other fugal pathogens.

Key words: Integrated Management, Post harvest. Adencoalymma alliaceum Fusarium spp. Antifungal activity.

GENETIC DIVERSITY ANALYSIS AND ASSOCIATION OF MOLECULAR MARKERS FOR IRON TOXICITY TOLERANCE IN RICE (ORYZA SATIVA)

MANISHA A. WAGH¹, ARJUN P¹. SWAPNIL PAWAR², E. PANDIT², S. K. PRADHAN², I. C. MOHANTY^{1*} ¹KK WAGH COLLEGE OF AGRICULTURE BIO-TECHNOLOGY, NASHIK, INDIA ²ICAR- NATIONAL RICE RESEARCH INSTITUTE, CUTTACK, ODISHA, INDIA

Rice *Oryza sativa* (2n = 24) isthe principal food crop of India that occupies the largest area under cultivation. It is an important cereal of India. Iron toxicity is one of the major limitation to rice yield. Yield losses associated with iron toxicity commonly range from 15% to 30% and in the case of harsh toxicity at younger stage. Molecular markers help in identification of quantitative trait loci (QTLs) associated with iron toxicity tolerance traits. In the present study, a set of 150 rice germplasm including landraces and high yielders released for cultivation was evaluated for various morphological characteristics with special reference to leaf bronzing due to iron toxicity both in soil as natural habitat considered as hot spot at the research farm of Regional Research and Technology Transfer station, OUAT, Bhubaneswar. The germplasms were phenotyped for the traits like days to 50% flowering, plant height, panicle length, number of grains per panicle, 1000 grains weight, yeild q/ha, leaf bronzing score and numbers of tillers/hill. All rice genotypes showed significant differences for LBI and other traits. Ganjamgedi, Hasanta, Jagannath, Hiranmayee were found to be resistant to Fe-toxicity, Sankaribako,Assamchudi, Jaifula were moderately resistant and Champeisiali, Khandasagar and Umarcudi were susceptible genotypes as revealed by morphological analysis. A subset of 120 rice accessions out of 150 were genotyped using a total of 14 SSR markers which showed polymorphism among the

genotypes and were used to identify genomic regions (QTLs) linked to iron toxicity tolerance in association mapping strategy. A total of 42 alleles were amplified from 14 SSR markers. There were 2 to 4 alleles identified per locus. The highest number of alleles (4) was found for the locus RM 407 and RM 202 the lowest number of alleles (2.0) was recorded RM 452, RM 590, RM1278, RM3 and RM 5638 with an average 3. A moderate diversity exists among the 120 rice genotypes are ranged from 0.236 to 0.664 with an average of 0.418. The major alleles frequency at a given locus ranged from 0.402 (RM 202) to 0.864 (RM 5638).Polymorphic information content (PIC) values varied from 0.208 to 0.593 with an average of 0.418. The highest PIC value was generated from RM 202 (0.593) followed by RM 8044 (0.556), RM 237 (0.545). Molecular analysis revealed wide diversity among the genotypes taken for the present study. Studies on marker-trait association with TASSEL software using both general linear model (GLM) and mixed linear model (MLM) revealed three markers-RM590, RM 31 and RM471 for GLM and RM105, RM590 and RM 471 with leaf bronzing index (LBI). GLM and MLM analyses together they detected RM590 and RM 471 associated with LBI with 3 to 5% phenotypic variability in both the cases. **Key word:**- Phenotyping, marker trait association, iron toxicity tolerance, genetic variation.

EFFECT OF WEED CONTROL METHOD ON GLADIOLUS (*GLADIOLUS GRANDIFLORUS* L.) CV. AMERICAN BEAUTY ON ECONOMICS

MANISHA BHASKAR^{*1}, KHIROMANI NAG², SAMIR KUMAR TAMRAKAR³ AND MADAN JHA⁴ *DEPARTMENT OF FLORICULTURE, COLLEGE OF AGRICULTURE, INDIRA GANDHI KRISHI VISHWAVIDYALAYA, RAIPUR, CHHATTISGARH

⁴DEPARTMENT OF VEGETABLE SCIENCE IGKV, RAIPUR (C.G)

The present investigation "Effect of weed control methods on gladiolus (*Gladiolus grandiflorus* L.) cv. American Beauty" was conducted in the Department of Floriculture and Landscape Architecture, College of Agriculture, Indira Gandhi Agricultural University, Raipur, Chhattisgarh during the *rabis*eason of year 2017-18. The experiment consisted of 11 treatment combinations of different weed control treatments *viz*. Pendimethalin 30% EC @ 1.0 kg a.i. ha⁻¹ (PE) + hand weeding at 30 DAP (T₁), Pendimethalin 30% EC @ 2.0 kg a.i. ha⁻¹ (PE) + hand weeding at 30 DAP (T₂), Oxyfluorfen 23.5% EC @ 0.25 kg a.i. ha⁻¹ (PE) + hand weeding at 30 DAP (T₃), Oxyfluorfen 23.5% EC @ 0.50 kg a.i. ha⁻¹ (PE) + hand weeding at 30 DAP(T₄), Pendimethalin 30% EC @ 1.0 kg a.i. ha⁻¹ (PE) + Fenoxaprop-p-ethyl 9.3% EC @ 0.10 kg a.i. ha⁻¹ at 30 DAP (PoE) (T₅), Pendimethalin 30% EC @ 2.0 kg a.i. ha⁻¹ (PE) + Fenoxaprop-p-ethyl 9.3% EC @ 0.10 kg a.i. ha⁻¹ at 30 DAP (PoE) (T₆), Oxyfluorfen 23.5% EC @ 0.25 kg a.i. ha⁻¹ (PE) + Fenoxaprop-p-ethyl 9.3% EC @ 0.10 kg a.i. ha⁻¹ at 30 DAP (PoE) (T₇), Oxyfluorfen 23.5% EC @ 0.25 kg a.i. ha⁻¹ (PE) + Fenoxaprop-p-ethyl 9.3% EC @ 0.10 kg a.i. ha⁻¹ at 30 DAP (PoE) (T₇), Oxyfluorfen 23.5% EC @ 0.25 kg a.i. ha⁻¹ (PE) + Fenoxaprop-p-ethyl 9.3% EC @ 0.10 kg a.i. ha⁻¹ at 30 DAP (PoE) (T₈), One Hand Weeding at 30 DAP (T₉), Two Hand Weeding at 30 and 650 DAP (T₁₀) and Un weeded (Control) (T₁₁). On the basis of economic assessment of various treatments, it may be inferred that application of Pendimethalin 30% EC @ 1.0 kg a.i. ha⁻¹ (PE) followed by one Hand Weeding at 30 DAT gave the highest additional profit of Rs. 1659254.0 hectare⁻¹ as well as the highest B:C ratio (1: 2.73) followed by Oxyfluorfen 23.5% EC @ 0.25 kg a.i. ha⁻¹ (PE) + hand weeding at 30 DAP with 1: 2.38 B: C Ratio as compared to other treatments. The minimum B:C ratio of 1.00 was recorded at control.

Key words: Weed management & Gladiolus

NEW TECHNIQUES OF AQUA GARDENING IN INDIA

NAG[,] K., L. S. VERMA, L. S. & SHARMA, G.

DEPTT. OF FLA, COA, IGKV RAIPUR (C.G.) INDIA, 492012

Water garden plants are called aquatic, because their life cycle revolves around water. Aquatic plants should not cover more than 50 – 60% of the water surface. There are basically three major categories of plants planted in the water garden. These are free floating, marginals and submerged. Aqua garden features like waterfalls, rockwork, lighting and fountains depend on budget, style of landscape and purpose of the garden pond. Plant selection depends on the size of the pond and the kind of look desired. Considerations such as water depth, amount of sunlight and how each species relates to its surroundings need to be taken into account when choosing plant material. Lake or pond bottoms containing large amounts of organic matter are the most suitable (Xuemin, 1987). On the other hand, sandy soils lack binding sites for nutrients and have been reported to produce rhizomes with an astringent flavor (Nguyen, 2001). Meyer (1930) compared plants growing in soil with a pH of 4.5., preparation of the floating beds - general shape of the beds *i.e.* rectangular. Submerged Aquatics are referred to as oxygenators and act as a natural filter contributing to the biological balance of a successful water garden. (Deb Spencer, *et, al* 2010.) Marginal plants are planted around pond edges to naturalize borders of the pond, floating plants, Cultivation on the floating beds. Plant chlorophyll absorbs light at wavelengths of 400 to 700 nm. Planting - types of plants, size and depth of pond. Mineral nutrients (Barko & Smart 1981). Land and water & agro-ecological management for resource access and benefit sharing on community basis are yet to develop. Submerged aquatic plants are superbly adapted to their underwater habitat.

Key word: techniques, aqua, garden & India

MUSHROOM FARMING TO ENSURE THE ECONOMIC SECURITY OF THE FARMERS

PANKAJ KUMAR*, ABHISHEK KUMAR, PUKHRAJ SINGH AND LALIT KR. VERMA, DEPARTMENT OF AG. ECONOMICS, J.V. COLLEGE BARAUT, BAGHPAT (U.P.)

India is fortunate to have a varied agro climate. Abundance of agro wastes, relatively low cost labor and a rich fungal biodiversity. These factors combined make India a potential major producer of temperate, tropical and subtropical Mushroom species. The production and consumption of mushroom is increasing very fast throughout the World, mainly due to greater awareness of their nutritive and medicinal attributes, unique flavor and texture. Mushroom farming today is being practical in more than 100 countries and the production is increasing at an annual rate of 6-7%. Present world production of mushroom is around 3.5 million tones as per FAO statistics. China alone is reported to grow more than 20 different types of Mushroom at commercial scale and Mushroom cultivation has become China's sixth largest industry. In India, Mushroom production shot-up from more 5000 tonnes in 1990 to over 1,20,000 tonnes in 2013. The land

resources in the world are limited but mushroom in indoor crop. Grow independent of Sunlight and does not require fertile land. Mushroom growing is raw materials and labor make Mushroom growing economically profitable in India. Indoor cultivation of Mushroom utilizes the vertical space and is regarded as the highest protein producer per unit area and time; Almost 100 times more than the conventional Agriculture& animal husbandry. Five to six crops of Mushrooms can be raised in a year under suitable condition. Mushroom production enhanced the livelihood security of farmers through generating additional income. In India it may become foremost source of incomes along with other source of income, which ultimately elevates the socio-economic status of farmer. **Keywords**: F.A.O., Mushroom farming and Income.

STUDIES ON EFFECT OF VARIETIES, TRANSPLANT AGES AND TRANSPLANT DENSITIES ON QUALITATIVE PARAMETERS OF *RABI* ONION (*ALLIUM CEPA* L.) UNDER AGROCLIMATIC CONDITIONS OF CHHATTISGARH PLAINS

OKESH CHANDRAKAR*, VIJAY KUMAR AND PRAVEEN KUMAR SHARMA

DEPARTMENT OF VEGETABLE SCIENCE, COLLAGE OF AGRICULTURE, IGKV RAIPUR (C.G.) 492012

A field experiment, entitled "Studies on effect of varieties, transplant ages and transplant densities on qualitative parameters of *rabi* onion (*Allium cepa* L.) under agroclimatic conditions of Chhattisgarh plains" was conducted at Horticulture Research cum Instructional Farm, Department of Vegetable Science, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur (Chhattisgarh) during *Rabi* 2012-13 and 2016-17. The soil of experimental site was clay loam in texture, neutral in soil reaction, low in available N, low in available P and high in available K status. The climate of the region is sub humid with an average annual rainfall of 1200-1400 mm. The crop received 63.7 mm and 60.1 mm rainfall during crop period during 2015-16 and 2016-17, respectively. The experiment was laid out in factorial randomized block design with three replications. The treatment consisted of twenty four treatment combination involved two varieties *i.e.*V₁- Nasik red, V₂- Agrifound light red, four transplant ages *viz*. A₁-35, A₂-45, A₃-55 and A₄-65 days old seedling and three transplant densities *viz*. D₁-15 x 15 cm, D₂-15 x 10 cm and D₃-10 x 10 cm. Result revealed that the two years mean indicated that interactions among V₂- Agrifound light red X A₁-35 days old seedling X D₂-15 x 10 cm recorded significantly highest qualitative characters (sulphur content in bulb, ascorbic acid content in bulb, neck- diameter, days to crop maturity, chlorophyll content (a & b) of onion in both years (2015-16 and 2016-17) and on the basis of mean data.

TILLAGE AND NUTRIENT MANAGEMENT FOR RESOURCE CONSERVATION IN COTTON + SOYBEAN INTERCROPPING SYSTEM

NARALE S. H.¹, PENDKE M. S.² AND HANWATE G.R.³

AICRP FOR DRYLAND AGRICULTURE, V. N. M. K. V. PARBHANI, 431402 MAHARASHTRA.

The field investigation entitled "Tillage and nutrient management for resource conservation and improvement of soil quality in Cotton + soybean biannual intercropping system" was started during the kharif season of year 2010 at the experimental farm of AICRP on Dryland Agriculture, V.N.M.K.V. Parbhani. With an objective of to study long term effect of low tillage and nutrient management on soil properties. The site should be fixed, Split plot design with three replications. Main treatments are Tillage management i.e. T_1 - Conventional tillage, T_2 - Reduced tillage + interculture and T_3 - Reduced tillage + herbicide + one interculture operation. Sub- plot treatments are Nutrient sources i.e. N_1 - FYM @ 5 t/ha, N_2 - Vermicompost @ 3 t/ha, N_3 - RDF (50%) + FYM (2.5 t/ha), N_4 - RDF (50%) + Vermicompost (1.5 t/ha) and N_5 - RDF (100% - Inorganic) with cropping system Cotton + Soybean (1:1). It is concluded during the year 2018-19 among tillage practices, reduce tillage + interculture recorded highest N, P and K as well as organic carbon. Among the nutrient sources, (N4) RDF (50%) + vermicompost (1.5 t/ha) recoded highest N,P and K as well as organic carbon followed by in the treatment of RDF(50%) + FYM (2.5 t/ha).

Keywords: Conventional tillage, Reduced tillage, Vermicompost, FYM

TREND ANALYSIS OF AREA, PRODUCTION, AND PRODUCTIVITY OF MAJOR FRUITS IN CHHATTISGARH PLAINS

NARESH KUMAR¹, DHIRENDRA KUMAR²

DEPARTMENT OF AGRICULTURAL ECONOMICS, INDIRA GANDHI KRISHI VISHWAVIDYALAYA, RAIPUR

Chhattisgarh state consists of three agro climatic zones i.e. Northern hills, Chhattisgarh Plains and Bastar Plateau. As Chhattisgarh plain zone with 1,33,087 ha. area under fruits contributing 50.89 percent of total area of fruits in Chhattisgarh. Thus, Chhattisgarh plain will be selected purposively for the study. Three blocks will be selected randomly in Bilaspur district under Masturi, Belha, and Takhatpur for the present study. Major fruits will be selected purposively based on the contribution of the area under fruit in Chhattisgarh Plains. So, three major fruits i.e. mango, banana and papaya contributing area which is 29.78, 12.67, and 7.21 percent to the total area of fruits in Chhattisgarh plain respectively. Highest area under fruits lies under Bilaspur district. Bilaspur district have highest area under papaya, mango and banana. So, Bilaspur district will be selected for papaya, mango and banana crop in the study. Three blocks will be selected randomly in Bilaspur district under Masturi, Belha, and Takhatpur for present study. Five villages will be selected from each block. So, fifteen villages will be selected from Masturi, Belha and Takhatpur each. In all, fifteen villages will be selected for the study. Ten farmers will be selected from each village. So there will be fifty farmers from Masturi, fifty farmers from Belha and fifty farmers from Takhatpur blocks in Bilaspur district. In all 150 farmers will be interviewed for the study. The primary data will collected in personal interview and secondary data will be collected from various government offices. The increase in production occurs due to increase in area as well as interactions of area and productivity of fruit crops in the periods.

EFFECT OF FEEDING SOYBEAN (GLYCINE MAX) STRAW ON FEED AND WATER INTAKE OF CROSSBRED CALVES.

NIKHIL R. SONONE, YOGESH N. PATIL

DEPARTMENT OF ANIMAL HUSBANDRY AND DAIRY SCIENCE, SDMVM'S, COA, GEORAI TANDA, AURANGABAD(MH), MGM'S, NKCA, GANDHELI, AURANGABAD(MH)431007

The present investigation entitled "Effect of feeding Soybean (*Glycine max*) straw on feed and Water intake of crossbred calves." was undertaken for a period of 90 days. Sixteen crossbred calves were divided into 4 groups. Thus each group was consisted of 4 calves for the study. The differences in respect of feed intake among the treatments indicating that all the calves consumed adequate quantity of feed and the incorporation of soybean straw in the ration of the calves did not influence the feed intake and also noticed that level of soybean straw had effect on the water consumption of calves. The feeding trial was conducted during early months of summer therefore the water intake seems to be higher.

SMART AGRICULTURE APPROACHES FOR TECHNOLOGY TRANSFER

NEELAM KUMARI¹ AND JOGINDER SINGH MALIK²

DEPARTMENT OF EXTENSION EDUCATION, CCS HARYANA AGRICULTURAL UNIVERSITY, HISAR (HARYANA) – 125004

Smart agriculture is a revolution in the agriculture industry that helps to guide actions required to modify and reorient agricultural systems to effectively support the development and guarantee food security during an ever-changing climate. The main focus of approaching smart agriculture is to increase agricultural productivity and incomes. The smart agriculture engages advanced technologies such as Big Data, GPS, IoT and connected devices. Smart agriculture helps in automated farming, collection of data from the field and then analyses it so that the farmer can make accurate decision in order to grow high quality crop. The field data are collected with the help of sensors, cameras, micro controllers, and actuators. Then the collected data are transferred via internet to the operator or the farmer for decision making. The use of new technology by a recipient is only one of its benefits that the recipient's economy obtains from that technology. Another, often larger, benefit is the diffusion of technology and skills within the host economy. Transfer of technology and knowledge contributes to learning and development of the capability of the industry. In response to the changing nature of agriculture and farmers' needs, the focus of extension in the past three decades has shifted away from transferring skills, technologies and knowledge related to the production of crops, livestock and forestry products from research to farmers, to developing technologies with farmers and catalyzing and facilitating innovation processes. This shift in focus is in alignment with the need for site-specific assessments to identify suitable agricultural technologies and practices.

Keywords: smart agriculture, economy, technology, income

EFFECT OF INORGANIC FERTILIZERS AND ORGANIC MANURES ON SOIL ECOSYSTEM

PATHAN OJEFKHAN IMDADALIKHAN AND MOHIT HUSAIN

DEPARTMENT OF SILVICULTURE AND AGROFORESTRY, ²SRF, DEPARTMENT OF NATURAL RESOURCE MANAGEMENT, ASPEE COLLEGE OF HORTICULTURE AND FORESTRY, NAVSARI AGRICULTURAL UNIVERSITY, NAVSARI – 396 450, GUJARAT, INDIA

The decline in the soil health due to the imbalanced fertilizers use has been recognised as one of the most important factor limiting crop yield and decline in soil health. Decline in soil health is due to nutrient depletion, soil structure deterioration, imbalanced use of plant nutrient, acidification and sub-optimal additions. Continuous uses of mineral fertilizer in soils are associated with increased soil acidity and nutrient imbalance and reduce crop yields. A combination of organic materials and mineral fertilizer is better management for the soil-Health. Furthermore, the use of organic manures with inorganic fertilizers showed a significant improvement in soil physico-chemical properties (bulk density, water holding capacity, porosity, pH and EC) and residual nutrients concentration (N, P, K and S). The use of inorganic manures and inorganic fertilizers has also showed a significant increase in soil health status over chemical fertilizers alone. INM practice including organic manures and recommended dose of NPK showed its best results with respect to yield parameters. The use of FYM alone with100% NPK sustained crop productivity and improved nutrient status. However, imbalance use of nutrients i.e. NP or N alone is adversely affecting the fertility of soil and the problem of soil acidity. Integrated use of organic fertilizers along with recommended use of fertilizers can help for sustainable agriculture production in soils with low organic matter. On the other hand, integrated plant nutrient supply not only sustains the soil and crop productivity but also ensures environmental and ecological security through adding leaf litter which improves soil properties.

Keywords: Soil, fertilizer, soil properties, INM, productivity.

VERTICAL GARDENING IN INDIA – NEW MODERN CONCEPT & PROSPECTS

NAG, K., VERMA, L. S. AND TIRKEY, T.

DEPTT. OF FLA, COA, IGKV, RAIPUR (C.G.) 492012

The new modern concepts for landscape development are keen on using any kind of concrete or glass, turning them in real vertical gardens. The urban areas making a smooth transition for a healthy green urban environment. Vertical garden was invented by Stanley Hart White who patented a green wall system in the late 1930s. In vertical gardens, various types of modular panels can be used along with geo-textile fabrics, growing media, irrigation and nutrient systems, and plants. Living walls are particularly suitable for cities, as they allow good use of available vertical surface areas. The living wall could also function for urban agriculture, urban gardening, or for its beauty as art. Green walls may be indoors or outside, freestanding or attached to an existing wall, and come in a great variety of sizes. One of the aesthetic solutions, named as vertical garden - green wall - wall garden- green facades - living walls in the literature, developed to minimize the devastating impacts of rapid urbanization. To provide green space alternatives to the city dwellers includes planted facade design and practices (Yüksel 2013). The systems are mostly implemented on the buildings and wall facades and require intense maintenance. A New

Concept of Modern Era 529 In 2001, his remarkable interior garden helped establish Paris's Pershing Hall hotel as an eminent address. In the year 2005, around thirty different modular systems for vertical gardens were available. Plants are installed on this felt layer as seeds, cuttings or already grown plants. The density is about thirty plants per square meter. The watering is provided from the top supplemented with nutrients. Watering and fertilization are automated. 536 Commercial Horticulture A pump and drip irrigation system supply nutrient-laden water, which slowly cascades down the wall through the felt material layers until reaching the bottom where a collector recovers the excess for reuse. The whole weight of the vertical garden including plants and metal frame is lower than 25 kg per square meter. **Key words:** vertical garden, India, modern, concept & prospects

DOUBLING THE FARMER INCOME THROUGH INNOVATIVE APPROACH

NEHA LAKRA¹, PRITANSHA BHAGAT², LAXMI BAGH²

¹DEPARTMENT OF AGRICULTURAL ECONOMICS, INDIRA GANDHI KRISHI VISHWAVIDYALAYA, RAIPUR ²DEPARTMENT OF ENTOMOLOGY, INDIRA GANDHI KRISHI VISHWAVIDYALAYA, RAIPUR ²DEPARTMENT OF AGRIBUSINESS AND RURAL MANAGEMENT, INDIRA GANDHI KRISHI VISHWAVIDYALAYA, RAIPUR

Doubling farmers' income implies increasing income from crop cultivation. At the current 3-per-cent growth rate it would take 25 years to double farmers' income. The focus must shift from increasing per acre productivity to gainfully employing farm households in other farm-related activities. There is need to involve the under-employed adults in rural households in low-skilled non-crop activities that integrate output from these activities into the existing or future markets. The Prime Minister's vision of doubling farmers' income by 2022 is worth serious attention. It is important to achieve the objective which could not only improve the well being of our farmers but can also be a trigger to boost agri-based manufacturing growth in rural India. We need to target activities that could be developed across India for booting rural incomes such as Goat rearing, an average herd size of 10-15 goats can produce an annual income 12,000-19,000 per household which is also driven by the growing market for meat. Honey production, Apart from helping in pollination, apiaries can be a low-cost source of income for rural households. Each hive produces about 40 kg of honey. At 75 per kg, it has a revenue potential of 3,000 per hive. Each household can manage 10 to 15 hives to generate an annual income of 30,000-45,000 through this enterprise. Bio-fuel market, crops like Jatropha should be permitted for genetic modification for increased oil yields. Oil companies should help village entrepreneurs to set up collection and processing units for absorbing every kg of seed produced and the output blended with hydrocarbon fuels as done in Brazil. These will bring low income rural households into a commercial farming and encourage small enterprises for collection, processing and extraction of bio-fuels. This creates industrial jobs in rural India and generates employment and non-farm income for rural households.

Key words: farming, farm income, rural households, entrepreneur

CROPPING STARTEGIES ADOPTED BY FARM WOMEN TO COMBAT CLIMATE CHANGE

POONAM TEWARI¹, PRATIBHA SINGH² AND DEEPIKA VERMA³

DEPARTMENT OF HOME SCIENCE EXTENSION, COLLEGE OF HOME SCIENCE, G.B. PANT UNIVERSITY OF AGRICULTURE AND TECHNOLOGY, PANTNAGAR – 263145 (UTTARAKHAND)

Climate change is a major environmental problem affecting livelihood security. Impact of climate change varies from one region to another. Mountain regions are highly vulnerable to climate change and have direct impacts on livelihoods. Marginal and small farmers are worst sufferers of it. The impact of climate change on mountain agriculture include decreased availability of water for irrigation, extreme events i.e. temperature variation, shift in rainfall, hail storms, increased insect-pest manifestation leading to failure of crop/fruit production, decline in crop yield, poor quality of crop/fruits /vegetables, shortening of maturity periods of crops which adversely affect the livelihood of farm families. Therefore, present study was conducted with the objectives to study the awareness of farm women regarding climate change, causes of climate change as perceived by them and situation specific coping strategies adapted. Data was collected from 100 rural women of 7 villages of Tarai and Hill zone of Uttarakhand state. Semi-structured interview schedule was used for data collection. Threepoint scale was developed to collect data on level of awareness on indicator of climate change. Results reveals that majority of the farm women were aware of various indicators of change whether fully or partially along with their consequences. Farm women had partial awareness that too of only a few causes of climate change, their effect on their life. Farm families had adapted diversification of crop varieties (61.00%), diversification of crop type(59.00%) and switching from mono cropping to integrated farming(41.00%) as the main coping strategies to combat climate change. Only a few farm women have adopted water harvesting techniques, change in traditional irrigation methods, planting calendar, inter-cropping, crop rotation and soil conservation methods. Thus, there is need to create awareness regarding climate change and its effect on livelihood security and impart training on coping strategies to combat climate change and to bring livelihood security.

Key words: Climate change, awareness, cropping strategies and adaptation.

NON-LINEAR MODELLING OF POPULATION DYNAMICS OF BROWN PLANTHOPPER IN BORO RICE

PRAMIT PANDIT^{1*}, K. N. KRISHNAMURTHY², BISHVAJIT BAKSHI²

¹DEPARTMENT OF AGRICULTURAL STATISTICS, BIDHAN CHANDRA KRISHI VISWAVIDYALAYA, MOHANPUR, NADIA, WEST BENGAL, INDIA, 741252

²DEPARTMENT OF AGRICULTURAL STATISTICS, APPLIED MATHEMATICS AND COMPUTER SCIENCE, UNIVERSITY OF AGRICULTURAL SCIENCES, BENGALURU, KARNATAKA, INDIA, 560065

Rice Brown Planthopper have co-evolved along with rice plant during its domestication of thousands of years. Dynamics of brown planthopper population, driven by various biological, environmental and climatological factors, affects the rice crop yield substantially, if not properly managed. As insect data often shows non-linear growth patterns, also suggested by the graphical display of brown planthopper data against time points of this study, fitting of different non-linear growth models are warranted to capture the pattern of the pest

population under study. With this context, an experiment was conducted to study the population dynamics of brown planthopper in rice at the farm of Uttar Banga Krishi Viswavidyalaya, Pundibari, West Bengal, India $(26.52^{\circ} \text{ N}, 89.11^{\circ} \text{ E})$ during boro season of 2016-17. Size of the field was 15 m × 10 m. The rice crop was sown in the first week of February and transplanted in the first week of March. No pesticides were used in order to observe natural pest population build up. 15 sample area of size 270 cm × 120 cm were selected using random number table, which covered 32.4 per cent of the total experimental area. 13 plants from each sample area were sampled by using 'W' pattern. Data on insect counts were recorded from the sampled plants from 21 DAT to 90 DAT (up to harvesting) at 3 days' interval. Among the various fitted non-linear models, logistic model was found to be the best fit, with lowest AIC (-49.22) and BIC (-48.15) values, followed by exponential model. Both the coefficients of logistic model (0.015 and 0.970, respectively) were found to be significant at 1 per cent level.

Key words: Boro rice, Brown planthopper, Modelling of rice pest, Non-linear modelling.

INTEGRATED WEED MANAGEMENT IN SPRING SWEET CORN FOR CONTROLING COMPLEX WEED FLORA PRITHWIRAJ DEY*, TEJ PRATAP

DEPARTMENT OF AGRONOMY, G.B. P.U.A.T., PANTNAGAR

A field experiment was conducted with objectives to study the bioefficacy of new generation herbicides against complex weed flora, to study the effects of different cultural and chemical control measures alone and their combinations on weeds, crop growth and yield and to find out the best method of weed management in spring sweet corn on the basis of crop yield and economic parameters. Pre-emergence application of atrazine at 1000 g/ha fb post-emergence application of halosulfuron-methyl at 90 g/ha was the most effective treatment in reducing weed density and twice hand weeding at 20 and 40 DAS was found most effective in reducing weed dry matter accumulation as compared to other treatments. All the weed control treatments significantly influenced the yield and yield attributing characters. Highest green cob yield was obtained with twice hand weeding at 20 and 40 DAS (15.46 t/ha) which was at par with preemergence application of atrazine at 1000 g/ha fb post-emergence application of tembotrione at 120 g/ha (15.31 t/ha) among the weed control treatments. The highest net return and B:C ratio was recoded with pre-emergence application of atrazine at 1000 g/ha fb post-emergence application of tembotrione at 120 g/ha which was followed by twice hand weeding at 20 and 40 DAS. Pre-emergence application of atrazine at 1000 g/ha fb application of tembotrione at 120 g/ha was found best among the herbicidal treatments in all respect. Twice hand weeding at 20 and 40 DAS was found comparable with pre-emergence application of atrazine at 1000 g/ha *fb* post-emergence application of tembotrione at 120 g/ha and can be used as an alternative subjected to availability of labourers. Pre-emergence application of atrazine at 1000 g/ha fb postemergence application of tembotrione at 120 g/ha was the best among all the weed control treatments in terms of net return (Rs. 99,823/ha), B:C ratio (2.89), weed control efficiency and yield (15.31 t/ha). No toxic symptom of any of the applied herbicides was observed on sweet corn at their recommended doses. Twice hand weeding at 20 and 40 DAS was the best among the cultural weed control treatments in terms of yield, net returns (Rs. 98,577/ha), B:C ratio (2.75), weed control efficiency and comparable to that of pre-emergence application of atrazine at 1000 g/ha fb post-emergence application of tembotrione at 120 g/ha, with low impact on soil microbial environment. Twice hand weeding at 20 and 40 DAS can be used as an alternative to chemical treatment subjected to availability of labour. Other alternatives with B:C ratio >2, such as alone post-emergence application of tembotrione at 120 g/ha (B:C ratio 2.5) and preemergence application of atrazine at 1000 g/ha fb one hand weeding at 40 DAS (B:C ratio 2.4), can also be adopted as remunerative strategies according to availability of labours, resources and circumstances. Intercropping with mungbean was not found effective in weed suppressing weeds in spring sweet corn.

Key words: Atrazine, Weed control efficiency, Mulching, Sweet corn, Tembotrione, Halosulfuron-methyl

IMPACT ASSESSMENT OF FRONT LINE DEMONSTRATION ON SORGHUM CROP UNDER TSP AREAS PRITAM O. BHUTADA, S.P MEHRE , L.N. JAWALE, M. ILLYAS, V.M GHOLVE, R. N AUNDHEKAR, ALL INDIA CO-ORDINATE SORGHUM RESEARCH PROJECT, SORGHUM RESEARCH STATION, VNMKV, PARBHANI

ALL INDIA CO-OKDINATE SORGHUM RESEARCH PROJECT, SORGHUM RESEARCH STATION, VNMKV, PARBHART Sorghum Research Station, VNMKV, Parbhani conducted 265 demonstrations on sorghum variety SPH-1641 and PVK-801, CSH-14 and CSV-27 during two consecutive years from 2017–18 to 2018–19. The critical inputs were identified in existing production technology through meetings and discussions with farmers. Delayed sowing, use of higher seed rate resulting into dense plant population, uneven plant population, uncontrolled weeds, ignorance about fertilizers and lack of plant protection measures, low MSP were the predominant identified causes of low productivity of sorghum. In the same sequence the other parameters like technological impact, economical impact and extension gap were analyzed for Impact assessment of front line demonstration on sorghum crop and feasibility of demonstrated technologies at grass root levels. The average results of two years study revealed that the grain yield & fodder yield under demonstration plots was 1452 Kg/ha & 3786 kg/ha respectively as compared to 888 kg /ha & 1957 kg/ha respectively in traditional farmer practices plots. The average of technology gap, extension gap and technology index for grain & fodder yield were found to be 2031 kg/ha, 564 kg/ha & 56.95 % and 7039 kg/ha, 1829 kg/ha & 19.93 % respectively. The results clearly indicate the positive effects of FLDs over the existing practices. Percentage increase grain and fodder yield over farmer practice was found 70% & 107 % respectively. Benefit: cost ratio was recorded to be higher under demonstrations against control treatments during the both the years of experimentation.

Key words: Sorghum crop, Front Line Demonstrations, Technology and Extension gaps, Technology index, Improved Technologies, Rainfed

RESPONSE OF DIFFERENT MEDIA ON GROWTH AND YIELD OF WATER SPINACH (Ipomoea aquatic Forsk) UNDER CONTAINER GARDENING

PRITESH PANDEY* AND MADAN JHA

DEPARTMENT OF VEGETABLE SCIENCE IGKV, RAIPUR (C.G.)

The field experiment was conducted during *Rabi* season of 2015-16 at the Horticulture Research farm, IGKV University, Raipur (C.G.). The experiment was laid out in a randomized block design with three replications. The treatments consisted of Thirteen combination of different agro input management practices viz., treatments T_1 Coco peat, T_2 Black Soil, T_3 Vermicompost (50%) +Coco peat (50%), T_4 FYM (50%) + Coco peat (25%) +Sand (25%), T_5 Coco peat (50%) +Sand (25%) + Black Soil (25%), T_6 Vermicompost (50%) + Black Soil (50%) + FYM (50%), T_8 Black Soil (50%) +Paddy Husk (50%), T_9 Sand (50%) +FYM (25%) + Coco peat (25%), T_{10}

Black Soil (50%) + Vermicompost (25%) +Charcoal (25%), T_{11} Black Soil (50%) +FYM (25%) + Sand (25%), T_{12} Black Soil (50%) +Paddy husk (25%) +Vermicompost (25%), T_{13} *Laterite* soil (50%) +FYM (25%) +Coco peat (25%). The maximum net profit/ha was recorded under treatment T_3 (Rs.47877.50) while minimum net profit/ha was obtained in treatment T_{11} (Rs. 25955.50). The maximum gross profit/ha was recorded in treatment T4 (Rs. 74952.00) whereas, minimum gross profit/ha was recorded in treatment T9 (Rs. 53477.00). Thus, the maximum income (both gross and net) was obtained with T3. The significantly maximum B:C ratio 1.76 was recorded under the treatment (T4). And the minimum B:C ratio 0.99 was recorded under the treatment (T8). **Key words:** *Vermicompost, FYM, Coco peat and Spinach*

INSECT-PESTS SUCCESSION OF SPINE GOURD (MOMORDICA DIOICA ROXB.) IN NORTHERN HILL REGION OF CHHATTISGARH

PRITI ANANT AND PAINKRA, K.L.*

DEPARTMENT OF ENTOMOLOGY, RMD COLLEGE OF AGRICULTURE AND RESEARCH STATION, AMBIKAPUR (C.G.) – 497001, INDIRA GANDHI KRISHI VISHWAVIDYALAYA, RAIPUR (C.G.)

Spine gourd *Momordica dioica* (Roxb.) is an important potential cucurbitaceous crop, it was attacked by six species of various insect pests *viz.*, cucurbit fruit fly (*Bactrocera cucurbitae* Coq.), hadda beetle (*Epilachna vigintioctopunctata* Fabricius), leaf miner (*Liriomyza trifolli* Burgess), red pumpkin beetle (*Aulacophora foveicollis* Lucas), bihar hairy caterpillar (*Spilosoma obliqua* Walker) and leaf eating caterpillar (*Diaphania indica* Saunders) in spine gourd during kharif 2017-18. Among the cucurbit fruit fly, hadda beetle and leaf eating caterpillar population first commenced from first week of August and leaf miner was observed in second week of August, while red pumpkin beetle was noticed in third week of August. The population of cucurbit fruit fly and hadda beetle increased gradually afterwards to reached peak population of 3.0 adult/plant and 6.0 grubs/adult/plant in the second week of September, respectively. The peak occurrence of leaf eating caterpillar of 2.0 larva/plant was observed in third week of September, respectively. The activity of bihar hairy caterpillar was observed short period during first to third week of October and highest (1.3 larva/plant) in second week of October. Weather parameters were found to be responsible for certain changes in the activities of insect-pests *viz.*, cucurbit fruit fly, hadda beetle, leaf miner, red pumpkin beetle, leaf eating caterpillar and bihar hairy caterpillar in spine gourd. The correlation was found positive and non-significant at minimum and minimum) and morning RH. While, in the case of bihar hairy caterpillar, correlation was found negative and non-significant at minimum temperature. Similarly, the correlation was found negative and non-significant at minimum temperature.

Key words: Insect-pests; Succession; Spine gourd; Chhattisgarh.

HERBICIDE RESISTANCE AND ITS MANAGEMENT: EMERGING TRENDS AND DEVELOPMENTS

R.K. SINGH & MRUTHYUNJAYA M

DEPARTMENT OF AGRONOMY, INSTITUTE OF AGRICULTURAL SCIENCES, BANARAS HINDU UNIVERSITY, VARANASI

Weeds are one of the major reasons for crop losses globally, threatening food production. For obtaining higher yields weed management is crucial and herbicides are the promising tools in suppressing the deleterious effect of weeds. However, input-intensive agriculture led to the extensive use of herbicides by the farming community and application of herbicide with same mode of action repeatedly over the years consecutively resulted in the development of resistance to herbicides. The mechanism of herbicide resistance is classified as target site resistance (TS) and non-target site resistance (NTSR) and non-target resistance mechanism is also referred as metabolic resistance and it is the complicated one. The target site resistance occurs when there is an alteration in target site whereas non target site resistance occurs when there is changes at other than the target site. The herbicide resistance has to be addressed by the recent technologies for successful management of weeds and to sustain the food production. The herbicide resistance management strategies includes usage of necessary herbicide specifically at recommended dosage rate, rotation of herbicides within herbicide groups and usage of herbicides mixtures. The emerging trends in herbicide resistance management are omics technology, nano-technology, zero tolerance approach, site specific or precision weed management, breeding for weed competitive crop cultivars and increasing prominence on pre emergence herbicides. The recent developments and trends related to herbicide resistance management offer new avenues for combating herbicide resistance and helps in sustaining food production and profitability with reduced herbicide dependency. **Keywords**: Food production, Herbicides, Herbicide resistance & Weeds.

COMPARATIVE PERFORMANCE OF SOYBEAN-SAFFLOWER CROPPING SYSTEM UNDER SELECTIVE MECHANIZATION vis-à-vis FARMERS PRACTICE in TERMS of YIELD, ECONOMICS and ENERGY BUDGETING

PRITAM BHUTADA, S.B.GHUGE AND P. A. MUNDE

ALL INDIA CO-ORDINATED RESEARCH PROJECT ON SAFFLOWER, V.N.M.K.V., PARBHANI (M.S.)

A field experiment was carried out during *kharif* and *rabi* season of year 2018-19 on clayey soil at experimental farm of AICRP on Safflower, VNMKV, Parbhani, Maharashtra, to study the effect of mechanization and non-mechanization practices on growth and yield of soybean (*Glycine max* L. Merill) – safflower (*Carthamus tinctorius* L.) sequence cropping system. The field experiment treatment consists of combinations of comprising practices of mechanization and non-mechanization (sowing, spraying and harvesting) and traditional practice on another plot of soybean-safflower cropping sequence. Experiment was laid out in two different plots each having 1000 m² area without replication one is under mechanization another one non-mechanization *i.e.* traditional practices for sowing, intercultural operations, spraying and harvesting, so that it tested in T-test plot design. The results of the experiments revealed that, application of mechanization practices in soybean-safflower cropping systems recorded significantly higher growth and yield of safflower than farmer practices. The seed yield was observed 24% increase under mechanized condition than to farmer's practice. Energy productivity (kg/MJ) was higher (0.49) under mechanized cultivation compared to farmer's practice (0.28).

ORGANIC FARMING AND VERTICAL FARMING: RECENT TRENDS IN AGRICULTURE PRITANSHA BHAGAT¹, NEHA LAKRA²

¹DEPARTMENT OF ENTOMOLOGY, INDIRA GANDHI KRISHI VISHWAVIDYALAYA, RAIPUR

²DEPARTMENT OF AGRICULTURAL ECONOMICS, INDIRA GANDHI KRISHI VISHWAVIDYALAYA, RAIPUR

Most challenging task for agricultural sciences today is to ensure for continuous and enough supply of food to growing human civilization. The threat to environment, due to dependence on chemical fertilizers and pesticides for increasing productivity and pest management respectively is major constraint affecting the global food production. These trends suggest new innovations with the main stream agriculture in integrated way. Vertical farming and organic farming are the research areas to fight these constraints. Vertical farming is done in open air or in mixed use sky scrapers for climate control and consumption. This kind of farming employs vertical stacking of the farms therefore small land can be utilized for more production. In addition, this technique is well suited for the rapidly growing global urban population as the demands of food supply can be met from within the cities and thus reducing the transportation cost and environment deterioration caused by fuels in the process. On the other hand organic farming which is also known as ecological agriculture or biodynamic agriculture, is based on the principles of minimization of the chemical inputs in the agriculture and hence is environment friendly. Nutrient management in organic agriculture is based on agronomic practices like crop rotations, soil fertility building via nitrogen and nutrient recycling using organic farming relies on use of resistant crops, crop rotation, increase in predators for natural control of the pests and increase in genetic diversity along with the judicious use of water resources and animal husbandry Thus, these techniques can be utilized for increasing the production and productivity to meet the growing food demands.

Key words: agriculture, organic farming, vertical farming,

EVALUATION OF TWICE-YIELDING PER YEAR TYPE JACKFRUIT (*ARTOCARPOSU HETEROPHYLLUS* L.) GREMPLASM AT BUNDELKHAND AGRO-CLIMATIC CONDITION R.K.PRAJAPATI¹ AND V.K. SINGH²

JAWAHARLAL NEHRU KRISHI VISHWA VIDYALAYA, KRISHI VIGYAN KENDRA¹, AND COLLEGE OF AGRICULTURE². TIKAMGARH, (M.P.)

The innovation approaches for development of fruit cultivation were made in Bundelhkand districts of Madhya Pradesh from 2006 by Krishi Vigyan Kendra and College of Agriculture Scientists through extension activates trainings and other promotion and motivation activities with allied districts forest, horticulture and agriculture department for development of fruit gowning interest among the farmers. The surveys were made to identification and characterization of different jackfruit germplasm in different districts of Bundelkhand viz., Sagar and Tikamagarh. The surveyed locations were at Sagar district, Keshli block and at Tikamgarh district in all blocks. In Tikamgarh district farmer Shri- Ambika Prasad Tiwari, Purani Tehari jackfruit plants was bearing Morphological characteristics were found as plant height (m) 8.91, girth of root stock(m) 1.62, girth of scion (m) 0.94, Canopy of height (m) 6.32, Spread N-S (m) 7.85, Spread N-S (m) 7.90, Flowering and fruiting characters, date of flowering-15th September and 15th February, blooming period-15 October and 15 March, maturity of fruit-after three month of flowering 15th January and 15th June, yield /tree/year of raw fruit(Kg) 1100, fruit size (cm) 32.1x51.0x80.32, No. of fruits/tree 460,weight of fruit(Kg) 2-2.5, average No. seeds per fruit 25-30, seed weight (g) 4-5, length of seed (cm) 3.0, width of seed (cm) 1.2, weight of seed (g) 2.8, pulp wt. per fruit (g) 8-10, Peel weight per fruit (g) 260, Germination (%) 85-90. On the basis of present investigation it can be concluded that the round the year bearing jackfruit of farmer of District-Tikamgarh (M.P.) was found superior in all the aspect like plant population, growth, fruit characters, flowering, yield, yield attributes and disease attacks fallowed by rest of jackfruit varieties of Sagar division of M.P. in all the aspects.

ANALYSIS OF EXTENT OF DIVERSIFICATION AND DETERMINANTS OF DIVERSIFICATION IN CROPPING PATTERN R.S.NIRPAL¹, R.R. SURYAWANSHI², R.A.SHELKE³ ^{1,2}MHATMA PHULE KRISHI VIDYAPEETH, RAHURI, AHAMADNAGAR (MH)413722.

³MGM NKCA, GANDHELI, AURANGABAD (MH)431007.

The concept of diversification conveys different meaning to different people at different levels. At the national level, it generally conveys a movement of resources, especially labour, out of agriculture to industry and services, a sort of structural transformation. Within agriculture, however, diversification is considered a shift of resources from one crop (or livestock) to a larger mix of crops and livestock, keeping in view the varying nature of risks and expected returns from each crop/livestock activity, and adjusting it in such a way that it leads to optimum portfolio of income. The present study is cropping pattern of Kolhapur district over 34 years beginning from 1980-81 and nature, extent and determinants of crop diversification at farm level. The average productivity of total cereals, total pulses, total oilseeds and total food grains increased during the period of study. The productivity of sugarcane, soybean and groundnut also Show increased considerably by 60.71%, 300.40% and 45.87% respectively. The magnitudes of diversification indices in Kolhapur were on lower side for cereals, other crops and pulses over base period 1980-81, which indicated that the extent of diversification for these group of crops was less compared to base period. The magnitude of diversification index for fruits, vegetables and total oilseeds increased over base period which indicate higher diversification.

Key words: cropping pattern, crop diversification, concentration of crops, Average productivity.

IN VITRO EVALUATION OF RHIZOBACTERIA, BOTANICALS AND CHEMICALS AGAINST *RALSTONIA SOLANACEARUM* CAUSING BACTERIAL WILT OF POTATO RITU KUMARI¹ AND R.K.RANJAN

DEPARTMENT OF PLANT PATHOLOGY, RPCAU, PUSA, SAMASTIPUR, BIHAR- 848125

Bacterial wilt caused by *Ralstonia solanacearum* is destructive disease of potato crop. *R. solanacearum* is difficult to manage due to its wide host range and ability to survive in soils and roots of non host plants including several weed. Hence, it is need to develop integrated disease management strategy against *R. solanacearum* manage this deadly disease. Experiments were conducted to evaluate the efficacy of rhizobacteria, botanicals and chemicals against *R. solanacearum* under *in vitro* conditions. The results showed that among the thirty two strains of rhizobacteria, twenty two strains of rhizobacteria were found to be effective against *R. solanacearum* producing inhibition zone

in which KSP-2 isolates produced highest zone of inhibition (31.16 mm). Crude aqueous extracts of eleven botanicals were evaluated against *R. solanacearum* in which six botanicals were found to be effective by producing inhibition zone. Among the effective botanicals garlic produced highest zone of inhibition (30.21 mm) which is followed by guava(25.11 mm), turmeric (17.17mm), marigold (16.21 mm), papaya (14.55 mm) and neem (13.77 mm) respectively. Six antibacterial chemicals were evaluated against *R. solanacearum* at 100 ppm, 250 ppm and 500ppm, among which chloramphenicol showed maximum antibacterial property at 100 ppm (15.96 mm)and 250 ppm (19.60 mm) concentration, where as streptocycline produced highest zone of inhibition at 500ppm (28.03 mm) concentration. **Key words:** *Ralstonia solanacearum*, Rhizobacteria, Plant extract, chemicals.

ROLE OF ENVIRONMENT ON DEVELOPMENT OF CHARACTERS.

SADHNA SAHA AND AMRITA GIRI

DEPARTMENT OF GENETICS AND PLANT BREEDING, INDIRA GANDHI KRISHI VISHWAVIDALAYA, RAIPUR (CG)

With the advent of increasingly accessible technologies for typing genetic variation, studies of gene-environment interactions (G×E) have proliferated in psychological research. Among the aims of such studies are testing developmental hypotheses and models of the etiology of behavioral disorders, defining boundaries of genetic and environmental influences, and identifying individuals most susceptible to risk exposures or most amenable to preventive and therapeutic interventions. Knowledge of the relative contributions of genotype (G), environment (E), and genotype and environment interaction (GxE) effects on crop quality leads to more effective selection in breeding programmes and segregation of more uniform parcels of grain better suited to the needs of customers. The primary objective of genotype and environment studies is to establish the level of genotype and environment interaction (GxE) relative to main factors such as genotype and environment. Some studies have focused on location and year, the components of environment. GxE studies that have focused on grain yield have primarily been interested in determining if GxE inhibits efficient selection. All quality traits are assessed as phenotypic observations and as such comprise components due to genotype, environment, and their interaction. The interaction factor refers to changes in differences between genotypes in different environments. Study of role on environment on development of characters is essential to know the changing respond of different genotypes in differently specified environments. **Keyword**: *Genotype, Environment, G×E interaction, therapeutic etc.*

PRINCIPLES AND PRACTICES OF PLANT NURSERY MANAGEMENT

¹ROHIT KUMAR* AND ²MINITA SHARMA

¹ RAJMATA VIJAYARAJE SCINDIA KRISHI VISHWAVIDYALAYA, GWALIOR (M.P.)

²DEPARTMENT OF TREE IMPROVEMENT AND FOREST BIOLOGY, COLLEGE OF HORTICULTURE AND FORESTRY, JHALAWAR, (RAJASTHAN)

Trees Outside Forests (TOFs) are the key source of tree based fodder, timber, fuel, food, fibre etc. The quality and quantity of remunerations expected from Trees Outside Forestsmainly depends on choice of species, seedling quality and their field management. The diverse Indian edapho-climatic condition offers the scope for planting a variety of species. Mango and Cashew in Deccan plateau, *Casuarina*, Cashew and Coconut trees in coastal area, Tea, Coffee, aromatic plants and Rubber in mountains, *Poplar* and *Eucalypts* trees in Indo-Gangetic plains, several vegetable crops and fruit trees in kitchen gardens are some well proven practices where quality planting materials (QPM) has been in demand. Due to the diverse edapho-climatic condition of India, the quality planting materials requirement is vary and also everlasting. Meanwhile the species or variety or genotypes suitable for cultivation in one region may or may not be remunerative in another region. Hence, development of location specific quality seedlings has the potential to increase the agriculture productivity. The availability of quality seedlings at lower cost offers ample scope for large scale planting. In this juncture, putting efforts on quality seedling production offers scope for sustainable agriculture. Nursery is pre requisite for producing quality seedlings in lesser input and nursery management is a potential tool to execute the activity in successful means.

Keywords: TOFs, Nursery management, Sustainable agriculture, quality planting materials.

BIOEFFICACY OF VARIOUS FORMULATIONS OF BIOPESTICIDES AGAINST WHITE GRUB, *LEUCOPHOLIS LEPIDOPHORA* (BLANCHARD) INFESTING SUGARCANE UNDER LABORATORY CONDITION

RASHMIKA ANANDA KUMBHAR

SECTION OF AGRICULTURAL ENTOMOLOGY, COLLEGE OF AGRICULTURE, KOLHAPUR, MAHARASHTRA, INDIA. Laboratory experiment was conducted on the "Bioefficacy of various formulations of biopesticides against White grub, *Leucopholis lepidophora* (Blanchard) infesting sugarcane crop" during 2016-2017 in the Agricultural Entomology Section, College of Agriculture, Kolhapur. In laboratory bioassay studies the various formulations of EPNs, EPF *M.anisopliae* and *B.bassiana* were tested for their efficacy against third instar grubs of *L. lepidophora* (Blanchard). The treatment with *M. anisopliae*-talc based @ 5 gm per litre recorded 81.95 per cent reduction in grub population and it was found to be significantly superior over all the treatments. Entomopathogenic Nematode-Powder @ 5 gm per litre showed 76.93 per cent reduction in grub population at 15 DAT were next in order of efficacy. The treatment with Entomopathogenic Nematode-Granules were next in order of efficacy. **Keywords**: Entomopathogenes, white grub, sugarcane

INTEGRATED MANAGEMENT OF BLACK SCURF OF POTATO CAUSED BY RHIZOCTONIA SOLANI

RAMPAL VERMA*, ANUPAM KUMAR AND SONU KATIYAR

DEPARTMENT OF PLANT PATHOLOGY, CSAUA&T KANPUR (208002) UP. INDIA

Potato (*Solanum tuberosum* L.) is one of the most important tuber crop and the fourth largest grown crop after rice, wheat and maize in the world. Potato is grown in almost all the parts of India. The crop is infected by a number of soil and tuber borne diseases such as common scab (*Streptomyces scabies*), Late blight (*Phytophthora infestans*), powdery scab (*Spongospora subterranea*), dry rot (*Fusarium spp.*),

Sclerotium wilt (*Sclerotium rolfii*), verticillium wilt (*Verticillium albo-atrum*), black scurf (*Rhizoctonia solani*) and sclerotinia stem rot (*Sclerotinia sclerotlorum*). Among these diseases, *Rhizoctonia solani* Kuhn (teleomorph: *Thanathephorus cucumeris* Frank donk) causing black scurf and stem canker on potato crops which cause both qualitative and quantitative damage (economically loss) to the potato growing areas all over the world. The incidence of black scurf has been reported upto 37 per cent from different parts of state (Khana and Sharma, 1993). The pathogen attacks young sprouts through epidermis and produces dark brown lesions, thereby killing the sprout before emergence which results in gappy germination. The fungus makes tubers ugly by forming black scurf (Sclerotia) on tuber surface. The symptoms were found on tuber, stem and stolon also. *Rhizoctonia solani* is a soil borne pathogen, so for effective management of this disease, it is requires implementation of an integrated disease management approach and knowledge of each of its stages. It is managed by the integrated approaches such as cultural control viz.; disease free tubers, organic amendmends, soil moisture, crop rotation and harvesting time, biological and chemical control. The organic amendments, biocontrol agents and chemical funicides may be effective in reducing the Black Scurf Disease Index (BSDI). So I will do my research work regarding the abstract.

Keywords:- Integrated management: organic amendmends, biocontrol agents and chemical fungicides, *Rhizoctonia solani*.

EFFECT OF DIFFERENT LEVELS OF PHOSPHORUS AND PSB SEED INOCULATION ON GROWTH AND YIELD OF COWPEA (VIGNA UNGUICULATA L.)

RICHA KHANNA*, BANTI, SATYBHAN SINGH, VIRENDRA SINGH AND PRADEEP KUMAR

SCHOOL OF AGRICULTURAL SCIENCES & ENGINEERING, IFTM UNIVERSITY, MORADABAD A field experiment was conducted during Summer season of 2019 at Agriculture Farm of IFTM University, Moradabad, to study the effect of different levels of Phosphorus and PSB seed inoculation on growth and yield of cowpea. The experiment consisted of eight treatment combinations *viz*. T₁- Control, T₂- Seed inoculation with PSB, T₃- NPK @ 20:40:40 kg/ha + seed inoculation with PSB, T₄- NPK @ 20:40:40 kg/ha, T₅- NPK @ 20:60:40 kg/ha + seed inoculation with PSB, T₆- NPK @ 20:60:40 kg/ha, T₇- NPK @ 20:80:40 kg/ha + seed inoculation with PSB and T₈- NPK @ 20:80:40 kg/ha, which were laid out in Randomized Block Design and were replicated thrice. Cowpea variety PL-5 was sown at a spacing of 60×20 cm on a sandy loam soil which was low in organic carbon (0.39 %), available nitogen (87.8 kg/ha) and available phosphorus (13.5 kg/ha) and was medium in available potassium (198 kg/ha). The experimental results indicated that, T₅ *i.e.* NPK @ 20:60:40 kg/ha + seed inoculation with PSB, resulted in superior values of all the growth parameters such as plant height, number of primary branches, dry weight and fresh weight at both 20 DAS and 40 DAS. This treatment has also reported an increased grain yield by 56.5 %, 33.0 %, 16.5 %, 26.3 %, 2.7 %, 4.7 % and 5.9 %, as compared to T₁, T₂, T₃, T₄, T₆, T₇, and T₈, respectively. The cowpea crop fertilized with NPK @ 20:60:40 kg/ha + seed inoculation with PSB has also resulted in highest net returns (79324.0 Rs/ha) and B: C ratio (3.06) as compared to other treatments in the experiment. This treatment has recorded 69.1 % and 35.6 % higher net returns as compared to control and only seed inoculation with PSB, respectively, which clearly indicates the suitability of this treatment in obtaining maximum yield and fetching higher economic returns for the cowpea growers.

Keywords: Cowpea, PSB, Phosphorus, growth, yield.

UTILIZATION OF KHAJUR (*Phoenix dactylifera*) CRUSH IN PREPARATION OF RABRI SACHINKUMAR S. KAHANDAL, SWAPNA B. GAIKWAD and R. R. SHELKE DEPARTMENT OF ANIMAL HUSBANDRY AND DAIRY SCIENCE COLLEGE OF AGRICULTURE, SONAI, NEWASA (MH)414105 COLLEGE OF AGRICULTURE, SONAI, NEWASA (MH)414105 DEPARTMENT OF AHDS, DR.PDKV, AKOLA (MH)

The chemical composition of khajur rabri was determined, in respect to fat ,protein, total sugar, ash, moisture and total solid. Sensory evaluation was carried out with the help of panel of judges in respect to colour and appearance, flavor, body and texture and overall acceptibility. Cost of preparation of khajur *rabri* was carried out by considering the prevailing market price for different constituent of milk *rabri*. Present investigation was carried out with five treatments and five replications. The treatment details were T_1 control sample, T_2 (97 per cent *rabri* + 3 per cent khajur crush), T_3 (94 per cent *rabri* + 6 per cent khajur crush), T_4 (91 per cent *rabri* + 9 per cent khajur crush), and T_5 (88 per cent *rabri* + 12 per cent khajur crush).

During the chemical analysis it was revealed that the fat content of khajur *rabri* was 19.88, 19.20, 18.09, 17.17 and 16.26. 17.02, 17.15, 17.28, 17.41, 17.53, Ash content was 3.02, 2.91, 2.73, 2.62, 2.51, moisture content was 44.18, 43.75, 43.26, 42.88, 42.26 and total solids content was 55.82, 56.25, 56.74, 57.12, 57.74, for the treatment T_1 , T_2 , T_3 , T_4 and T_5 respectively. In short fat, protein and Ash were normally decreased while total sugar, moisture and total solid were increased with increase in levels of khajur crush. For sensory evaluation the results revealed that overall acceptability scores obtained were 7.11, 7.52, 7.89, 7.14, and 6.76 for the treatment T_1 , T_2 , T_3 , T_4 and T_5 respectively. The treatment T_3 scored significantly highest scores for flavour, colour and appearance, consistency and overall acceptability which were found superior amongst all the treatments. The khajur crush prepared from all combinations of buffalo milk *rabri* was found acceptable. The cost of production per kg of khajur rabri was slightly decreased with increase in rate of addition of khajur crush percentage. i.e. Rs. 162.41 (T_1), Rs. 160.10 (T_2), Rs. 157.37 (T_3), Rs. 155.23 (T_4) and Rs. 152.73 (T_5).

Key word:- Khajur, Rabri.

COMPARATIVE ANALYSIS OF VARIOUS STRATEGIES FOR MANAGEMENT OF EARLY BLIGHT OF TOMATO INCITED BY Alternaria solani (ELLIS AND MARTIN) JONES AND GROUT

RAJENDRA KUMAR BAIS¹, VED RATAN¹, SUMIT KUMAR², ASHUTOSH TIWARI¹ AND SOMESH¹

¹DEPARTMENT OF PLANT PATHOLOGY, C.S.A. UNIVERSITY OF AGRICULTURE AND TECHNOLOGY, KANPUR, UTTAR PRADESH, INDIA

²DEPARTMENT OF MYCOLOGY AND PLANT PATHOLOGY, INSTITUTE OF AGRICULTURAL SCIENCES, BANARAS HINDU UNIVERSITY, VARANASI, UTTAR PRADESH, INDIA

The present investigation was conducted to test the efficacy of bio-control agents, plant extracts and fungicides *in vitro* against *Alternaria solani* causing early blight of tomato. The efficacy of two fungal and one bacterial antagonist (*T. harzianum*, *T. viride* and *P. fluroresenes*) were evaluated through dual culture technique. Six plant extracts *viz.*, *Azadirachta indica*, *Zingiber officinale*, *Allium sativum*, *Eucalyptus*

spp, *Datura stramonium* and *Ociumum sanctum* at five concentrations *i.e.* 1%, 2%, 3%, 4%, and 5%. and six combinations of systemic and non-systemic fungicides *viz.*, Mancozeb, Roko, Carbendazim, Companion, Blitox 50 and Sanchar also at five concentrations *i.e.* 50ppm, 100ppm, 250ppm, 500ppm and 1000ppm were evaluated through poison food technique. Among the bio-control agents, highest inhibition of radial growth of test fungus was recorded in *P. fluorescens* which showed maximum inhibition (56.03%) followed by *T. harzianum* (51.58%), while minimum mycelium growth inhibition was observed in *T. viride* (47.78%). Among different plant extracts used, *Allium sativum* was found to be very effective in inhibiting the mycelial growth of pathogen significantly in all concentrations followed by *Azadirachta indica*. Among combination of systemic and non-systemic fungicides at different concentrations, the significant maximum growth inhibition was recorded in Metalaxyl + Mancozeb (Sanchar) at 100, 250, 500 and 1000 ppm concentration which inhibited the fungal growth as 100 per cent, followed by Mancozeb and Carbendazim + Mancozeb.

Keywords: Fungal pathogen, Mycelial growth, Bio control agents, Plant extracts, Fungicides.

COMPARATIVE ANALYSIS OF VARIOUS STRATEGIES FOR MANAGEMENT OF EARLY BLIGHT OF TOMATO INCITED BY ALTERNARIA SOLANI (ELLIS AND MARTIN) JONES AND GROUT

RAJENDRA KUMAR BAIS¹, VED RATAN¹, SUMIT KUMAR², ASHUTOSH TIWARI¹ AND SOMESH¹ ¹DEPARTMENT OF PLANT PATHOLOGY, C.S.A. UNIVERSITY OF AGRICULTURE AND TECHNOLOGY, KANPUR, UTTAR PRADESH, INDIA

²DEPARTMENT OF MYCOLOGY AND PLANT PATHOLOGY, INSTITUTE OF AGRICULTURAL SCIENCES, BANARAS HINDU UNIVERSITY, VARANASI, UTTAR PRADESH, INDIA

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Keywords: Fungal pathogen, Mycelial growth, Bio control agents, Plant extracts, Fungicides.

EVALUATION OF VARIOUS BOTANICALS AGAINST Alternaria alternata (Fr.) Keissler In vitro CONDITION

RUPSING B. RAJPUT

DEPARTMENT OF PLANT PATHOLOGY, COLLEGE OF AGRICULTURE, DONDAICHA, (M.H.)425408

Investigation on leaf spot disease (*Alternaria alternata* (Fr.) Keissler. of brinjal (*Solanum melongena* L.) under South Gujarat condition was carried out to find suitable management strategies. The hazardous effects of chemicals used in plant disease management have diverted plant pathologists to find out an effective alternative method with little or no adverse effect on environment. The aqueous extracts of commonly available eleven plant species belonging to ten different families were evaluated *in vitro* for their inhibitory effect on the mycelial growth and spore formation by *A. alternata*. The results revealed that all the phytoextracts tested were significantly superior over the control in checking the growth of the pathogen. The rhizome extract of turmeric (54.42%) was found significantly superior in inhibiting mycelial growth over the rest. The next best in order of merit was Garlic (50.67%). The sporulation was inhibited by all the phytoextracts as compared to control. Thus, extract of Turmeric, Garlic and Neem proved most effective phytoextracts in inhibiting mycelial growth as well as in preventing spore formation.

Keywords: phytoextracts, brinjal, A. alternata.

EVALUATION OF SOME SAFER INSECTICIDES AGAINST MUSTARD APHID, *LIPAPHIS ERYSIMI* (KALT) AND IMPACT ON PREDATORS

S. S. DHAKA, F. MOHSIN, N. C. TRIPATHI AND R. C. SETHI SVPUA&T, KRISHI VIGYAN KENDRA, PILIBHIT-262001 U.P.

Efficacy of different novel insecticides as foliar application was studied against mustard aphid *Lipaphis erysimi* (Kalt) and their effect on the predator of aphids *Coccinella septumpunctata* was also recorded during 2018-19. The insecticides Acetamiprid 20 SP (125 g/ha), Imidacloprid 17.8 SL (150 ml/ha), Thiamethoxam 25 WDG (100 g/ha), Acephate 75 SP (500 g/ha), Profenofos 50EC (1000 ml/ha), Oxydemeton methyl 25 EC (1000 ml/ha) and Dimethoate 30 EC (1000 ml/ha) were sprayed at normal recommended doses and a control plot was also maintained for comparison. Efficacy was assessed by counting the aphids and predators population and mortality in rapeseed mustard field plots. All tested insecticides performed better against aphid as compared to untreated plots. Acetamiprid proved as the best with 100 percent aphid population reduction followed by acephate , thiamethoxam, imidacloprid, profenofos, dimethoate and oxydemeton methyl with 100, 100,100, 97.41, 97.14 and 97.16 percent reduction, respectively. In terms of safety for the predator, *Coccinella septempunctata*, the thiamethoxam was found best as the coccinelids were increased by 14.13 percent in treated plots. **Key words:** *. Brassica campestris*; *Lipaphis*; insecticides; mortality; Aphid

SYNTHESIS OF ZNO NANOPARTICLES THROUGH BIOLOGICAL APPROACH AND ITS CHARACTERIZATION

SANJIB KUMAR SAHOO¹*, G.K. DWIVEDI¹, JAIPAUL¹ AND RAJEEW KUMAR²

¹DEPARTMENT OF SOIL SCIENCE, G.B. PANT UNIVERSITY OF AGRICULTURE AND TECHNOLOGY, PANTNAGAR, INDIA

²DEPARTMENT OF AGRONOMY, G.B. PANT UNIVERSITY OF AGRICULTURE AND TECHNOLOGY, PANTNAGAR, INDIA

The use of nanoparticles is gaining momentum in the present day agriculture scenario because of its unique properties to improve crop production and quality. But due to its low availability as commercial formulation and higher price, it is yet to be popularized. Keeping this in view, an experiment was conducted to synthesize Zinc Oxide (ZnO) nanoparticles through biological approach (green synthesis method) in the laboratory of the Department of Soil Science, GBPUAT, Pantnagar. In the green synthesis method, leaf extracts of *Azadirachta indica*, zinc acetate dihydrate and sodium hydroxide were used to prepare ZnO nanoparticles by hydrothermal process. The characterization of the synthesized ZnO nanoparticles was done using UV-visible spectroscopy and scanning electron microscopy (SEM). UV-visible spectroscopy showed absorbance peak at 368 nm wavelength, which confirms formation of ZnO nanoparticles. From the scanning electron microscopy results, the average size of the particles was 111 nm and surface morphology was triangular to spheroidal in shape. This method of synthesis through green synthesis showed that nanoparticles can be synthesized easily with the use of locally available plant materials (eg. Neem leaf extract) which is usually at a lower cost of production and safer to the environment. **Key words:** Nanoparticles, ZnO, Green synthesis, *Azadirachta indica*.

DISEASE CONTROLLING POTENTIAL OF *TRICHODERMA HARZIANUM* AND *TRICHODERMA VIRIDE* AGAINST COLLAR ROT OF CHICKPEA

SHWETA MISHRA AND R.K.S TIWARI

¹DEPARTMENT OF PLANT PATHOLOGY, INDIRA GANDHI KRISHIVISHWAVIDHYALAY, RAIPUR, CHHATTISGARH ²BTC COLLEGE OF AGRICULTURE AND RESEARCH STATION ,BILASPUR

Disease controlling potential of *Trichoderma* strains evaluated in vivo against collar rot in chickpea. Ten *Trichoderma strains*(T1,T2,T3,T4,T5,T6,T7,T18,T28) were taken among which nine were *Trichoderma harzianum* and one *Trichoderma viride* (T18). All strains of *Trichoderma harzianum / Trichoderma viride* was superior over control for disease controlling parameters i. e mortality percentage , no. of pods per / plant ,yield (quintal/hectare), yield (g/plot),Test weight. sick soil was prepared using sclerotia of *Sclerotium rolfsii* @ 3800/ plot. Talc powder based formulations of different strains of *Trichoderma* spp. were used as seed treatment. Seeds of chickpea were treated with Different strains of *Trichoderma* spp. @ 10 g /kg seed. Hexaconazole +Zineb was used @ 3 g kg/seed. Untreated control was kept for making comparison. Seeds @ 100 kg/ha were sown in each plot under randomized block design with three replications. Fertilizers i.e. NPK @ 20:60:0 / ha were applied as basal dose. Plant population / plot were counted from each plot after 25 days of sowing *Trichoderma* strains T18 and T28 were more effective showing higher degree of parasitism on *Sclerotium rolfsii* under field against collar rot in chickpea . Similarly , minimum mortality percentage was recorded in *Trichoderma viride* strain T18 followed by T 28,T 6,T 7 and maximum Test weight (weight of 100 grain) was recorded in strain T6 and T18.

Key words: Chickpea, Sclerotium rolfsii, Trichoderma harzianum, Trichoderma viride Disease controlling potential.

STUDIES ON INSECT-PESTS OF SOYBEAN (GLYCINE MAX) WITH SPECIAL REFERENCE TO SEASONAL INCIDENCE OF LEPIDOPTERAN DEFOLIATORS

SARVESH KUMAR BRAHMAN, AK AWASTHI, SHAILENDRA SINGH AND MADAN KUAMR JHA DEPARTMENT OF ENTOMOLOGY IGKV, RAIPUR (C.G.)

DEPARTMENT OF VEGETABLE SCIENCE IGKV, RAIPUR (C.G.)

The field experiment was conducted at BTC College of Agriculture and Research Station, Bilaspur, Chhattisgarh, during 2016-17. Study about seasonal incidence of pre-dominant lepidopteran insect-pests in soybean crop the soybean leaf folder (Omiodes indicata Fab.), tobacco caterpillar (Spodoptera litura Fab.), green semilooper (Chrysodexis acuta Walker), leaf webber (Anarsia ephippias Mullar) and pod borer (Helicoverpa armigera Hub.) were major defoliator insect causing damage at various growth stages of the soybean crop. The peak activity of Omiodes indicata Fab. (1.67 larvae/mrl) and Spodoptera litura Fab. (1.47 larvae/mrl) were observed during third week of September. Whereas, Chrysodeixis acuta (1.0 larvae/mrl), Anarsia ephippias (0.6 larvae/mrl) and Helicoverpa armigera (0.67 larvae/mrl) were recorded during first week of September, third week of August and fourth week of August, respectively.

Keywords: seasonal incidence, peak activity, lepidopteran defoliator and soybean

SEASONAL INCIDANCE AND CHEMICAL MANAGEMENT SAFFLOWER APHID (UROLEUCON COMPOSITAE THEOBALD.)

SONALI C. KUMBHAR¹, D. S. MUTKULE² AND SOJWAL S. SHINDE³ ^{1,3} DEPARTMENT OF AGRICULTURAL ENTOMOLOGY, MPKV RAHURI, MAHARASHTRA, INDIA. ²DEPARTMENT OF AGRICULTURAL ENTOMOLOGY, COLLAGE OF AGRICULTURE, LATUR, MAHARASHTRA, INDIA.

Investigations were carried out to study the seasonal incidence, bio-efficacy of different insecticides against major insect-pests of safflower and screening germplasm lines against safflower aphids at the Department of Agricultural Entomology, Oilseeds research station, Latur during Rabi 2016. The aphid (*Uroleucon compositae*) infestation on safflower crop was noticed from Oct to March. The maximum level of infestation (142 aphid/5cm twig) was recorded during 3rd SMW in January, the pest infestation found it active from January to February.

The predator infestation on safflower crop from October to March. The maximum level of infestation (0.7 aphid/5cm twig) was recorded during 2nd SMW in January, the pest infestation found it active from January to February. Bio-efficacy studies were carried out under field conditions using randomized block design. Six insecticides at recommended doses in Safflower were evaluated for their bio-efficacy against major insect-pests of Safflower. Pymertizine 0.03 % recorded significantly minimum number of Safflower aphid, Uroleucon compositae, to the extent of 4.00, 2.00, 4.00, 5.00 and 16.06 aphid per 5 cm twig after first spray and 9.00, 2.00, 8.00, 7.00, and 11.67 per 5 cm twig after second spray at 1, 3, 7, 10 and 14 days, respectively. Pymertizine 0.03 % evidenced next best treatment in suppressing aphid population to the extent of 14.00, 11.00, 13.00, 18.00 and 28.00 per 5 cm twig after first spray and 19.00, 10.00, 16.67, 20.00 and 25.67 per 5 cm twig after second spray at 1, 3, 7, 10 and 14 days, respectively.

Keyword: Safflower, aphid (Uroleucon compositae), and Pymertizine

LOAN UTILIZATION PATTERN OF KISAN CREDIT CARD HOLDERS IN BARAUT BLOCK OF BAGHPAT DISTRICT (U.P.)

SOORAJ YADAV*, ARUN SOLANKI, AND LALIT KUMAR VERMA DEPTT. OF AGRICULTURAL ECONOMICS, J.V. COLLEGE, BARAUT (BAGHPAT)

The Kisan Credit Card scheme introduced in the year 1998 with the objective of fulfillment of credit requirement of the farmers in hasslefree manner for raising agricultural production. There has been tremendous increase in number of Kisan Credit Cards in the rural areas during the last five years. Keeping the importance of KCC, the present study was an attempt to Loan Utilization Pattern of KCC as perceived by the farmers. The present investigation was carried out in Baraut Block of Baghpat district (U.P.) with a sample of 48 KCC holders. Utility of Kisan Credit Card has been affected by various kinds of problems as perceived by the KCC holders in the present study. The major problem faced by the KCC holders that lake of co-operation and guidance, lack of sufficient know ledge about scheme, Due to complicate loaning procedure. As per policy all the KCC holders have to repay their loan in same financial year. They can available Loan again in the next financial year. While only 16.67 percent KCC holders repay their loan with in 6th month, 83.33 percent KCC holders repay their loan with in 12th month in the study area. The KCC holders were feeling that the procedure for loan recovery is not good. Keywords: Kisan Credit Card (KCC) Scheme, Loan Utilization Pattern and Rural area.

FERTIGATION: A PIONEERING APPROACH FOR INCREASING RESOURCE USE EFFICIENCY

SEEMA AND KAVITA

DEPARTMENT OF SOIL SCIENCE, CCS HARYANA AGRICULTURAL UNIVERSITY, HISAR-125 004

In the present time, lot of emphasis is being given in improving the irrigation and fertilizer management practices to increase the crop production, resource use efficiency and sustainable productivity levels. Water and fertilizer use efficiency improves with drip irrigation system as it has the greatest potential for the effective use of water and fertilizers. Fertigation is the technique of supplying soluble fertilizer to crops through an irrigation system. Drip fertigation saves fertilizers up to 25 per cent to 40 per cent as well as reduces water consumption upto 30 to 70 per cent as compared to the traditional methods (surface flood, basin, furrow) of irrigation. Fertigation has various advantages over other methods such as higher water and fertilizer use efficiency, minimum losses of nutrients through leaching and more availability of nutrients in the root zone of plants, optimum concentration of nutrients in soil solution and lower cost of production. It is practiced extensively for commercial high value crops agriculture and horticulture crops such as fruit crop, ornamental and vegetables. Key words: Fertigation, input use efficiency, productivity

WEED MANAGEMENT OF BLACK GRAM (VIGNA MUNGO L.) UNDER NORTHERN ZONE

SHIKHA DUBEY¹, PUSHKAR DIXIT² AND VIKASH YADAV³

¹ M.SC, BANDA UNIVERSITY OF AGRICULTURE AND TECHNOLOGY, BANDA.

² AGRONOMIST, SOIL AGRO LIMITED, NIGERIA

³ RESEARCH SCHOLAR, CSAUA&T, KANPUR.

Pulses occupy a unique position in every system of Indian farming as a main, catch, cover, green manure and intercrop. These are the main source of protein particularly for vegetarians and contribute about 14 per cent of total protein of an average Indian diet. This crop was cultivated on an area of about 45 lakh hectares with a production of 32 lakh tonnes and productivity of 600 kg/ ha in our country during 2017-18. Black gram (Vigna mungo L) is one of the most important pulse crops in north India which is grown under irrigated, rainfed and rice-fallow conditions. Weeds compete for water, nutrients and space and cause up to 45 per cent yield loss in black gram. India to evaluate the different chemical herbicides applications and effectiveness of weed control practices for higher grain yield and income of blackgram. The dominated weed species among monocot weeds are Cynodan dactylon, Cyperus rotantus, Dactyloctenium aegyptium and Chloris barbata. Among dicot weeds species Traianthema Portulacostrum, Parthenium hysterophorus, Phyllanthus amarus and Cleome viscosa were observed during growing seasons in the fields. The control of weeds during critical period of crop-weed competition is very important so as to avoid yield loss. Under irrigated condition, weed management through pre-emergence herbicides is proven technique in black gram. Application of pendimethalin at 0.5 kg/ha followed by one hand weeding (HW) at 30 days after sowing (DAS) controlled all the associated weeds resulting higher weed control efficiency, enhanced grain yield and net monetary return in black gram. The application of pendimethalin weed control about 85% in black gram field.

Keywords: Black gram, weed management, Pendimethalin

IN-VITRO EVALUATION OF BOTANICALS AGAINST PATHOGEN ISOLATED FROM DISEASED POTATO TUBERS SANWANI, V.¹, NAG, K.², AND ABHILASHA A. LAL³ ^{1,3}DEPTT. OF PLANT PATHOLOGY, SAM HIGGINBOTTOM UNIVERSITY OF AGRICULTURE TECHNOLOGY AND SCIENCES. ALLAHABAD, U.P. INDIA ²DEPARTMENT OF FLA, COA, IGKV, RAIPUR (C.G.), 492012

The experiment was conducted as a completely randomized design with seven treatments and three replications. The treatments were 10% concentrations of leaf extract. The treated plates were then incubated at 26 °C in the dark. The average diameter of the mycelia growth inhibition zone around the paper discs loaded with each treatment was measured seven days post incubation. The growth inhibition percent was calculated using the formula: IP=c-t/c×100, where IP was the growth inhibition percent, c and t were the diameter of growth inhibition zone in negative control and each of the other treatments. *Saraca asoca* leaf extract (10.00%), *Jatropha curcas* leaf extract (10.00%) *Lantana camara* leaf extract (10.00%), *Mentha spicata* leaf extract (10.00%), *Ocimum sanctum* leaf extract (10.00%), *Cymbopogon citratus* L. leaf extract (10.00%) and *Aloe barbadensis* Mill. leaf extract (10.00%) leaf extract (10.00%) were tested against *Fusarium solani* using poison food technique using Potato Dextrose Agar (PDA) which used as basal medium. Both the treatments tested were significantly effective in inhibiting the growth of pathogen over control. *Saraca asoca* leaf extract (10.00%) showed minimum inhibition percent (39.63%) as compared to *Jatropha curcas* leaf extract (10.00%) showed maximum inhibition percent (75.93%).

EFFECT OF WEATHER PARAMETERS ON INCIDENCE OF RED ROT DISEASE IN SUGARCANE

SAURABH DUBEY¹, MD. MINNATULLAH¹, SHIVAM MAURYA¹, C. S. CHAUDHRY¹, S. P. SINGH² AND BIPIN KUMAR³ ¹DEPARTMENT OF PLANT PATHOLOGY, RPCAU, PUSA ²DEPARTMENT OF AGRICULTURAL ECONOMICS, RPCAU, PUSA ³TECHNICAL CELL, SRI, RPCAU, PUSA

Agro-climatic conditions influence the crop growth and nutrient use efficiency. A mean temperature of 28 to 32 $^{\circ}$ C and relative humidity of 70-85 percent is best suited for the growth of sugarcane. Several factors which are responsible for the incidence of the disease in which different weather parameters also play a crucial role in determining the cause and severity of the disease. Thus, the present study was undertaken to find out the effect of weather on incidence of red rot disease caused by *Collectotrichum falcatum* Went in sugarcane at SRI, Pusa farm during cropping season of 2018. The maximum temperature ranged from 22.5 $^{\circ}$ C to 36.9 $^{\circ}$ C and minimum temperature ranged from 7.3 $^{\circ}$ c to 26.6 $^{\circ}$ c during the crop season. The maximum (25.5 %) disease incidence occurred during second fortnight of August. Weather parameters corresponding to this period were maximum and minimum temperature, relative humidity at 14 hours (88.0 and 74.0 %), rainfall (115.8 mm) and sunshine (2.4 hours). Minimum temperature, relative humidity at 14 hours and rainfall showed positive correlation (r = 0.512, 0.45 and 0.73) respectively whereas, sunshine showed negative correlation (r = -0.42) with disease incidence. Multiple linear regression also revealed that all weather parameters together governed 68.8% towards disease incidence (R² = 0.688). Thus, the minimum temperature, relative humidity and rainfall showed statically significant positive weather correlation with disease incidence and these weather parameters appeared to be most significant contributing condition for red rot disease development. **Keywords** - Weather, Incidence, Red rot, Sugarcane.

COST EFFICIENCY OF SUGARCANE PRODUCTION: A STUDY OF SAMASTIPUR AND BEGUSARAI DISTRICTS OF BIHAR (INDIA)

SHIVA PUJAN SINGH¹, NASIM AHMAD², TULIKA KUMARI³ AND MD. MINNATULLAH⁴ DR. RAJENDRA PRASAD CENTRAL AGRICULTURAL UNIVERSITY, PUSA (SAMASTIPUR), BIHAR ¹AGRICULTURAL ECONOMICS, SRI, RPCAU, PUSA, SAMASTIPUR (BIHAR) ²DEPARTMENT OF AGRICULTURAL ECONOMICS, RPCAU, PUSA, SAMASTIPUR (BIHAR) DEPARTMENT OF AGRICULTURAL ECONOMICS, RPCAU, PUSA, SAMASTIPUR (BIHAR) ⁴SRI, RPCAU, PUSA, SAMASTIPUR (BIHAR)

The Present investigation estimates the cost efficiency of sugarcane farming in Samastipur and Begusarai district of Bihar (India). Stochastic cost function model was applied to estimate the cost efficiency of sugarcane cultivation and for this, multistage sampling technique was applied to collect the primary data. The results of the study revealed that independent variables like human labour cost, tractor cost, irrigation cost, seed cost, fertilizers and manure cost were in conformity with the priori expectation but plant protection cost and production were found to be negative showing that inadequate plant protection measures could reduce the production. Further, inefficiency and factors affecting cost inefficiency were also assessed. The mean inefficiency score was found to be 1.10 indicating 10% inefficiency prevailed in the cost of production of sugarcane in the study area. The important factors like age, education level and area under sugarcane affecting inefficiency were found negative and significant reflecting that younger and educated people had better access to extension agencies and likely to have comparatively good knowledge of modern farming techniques. The expansion in area under sugarcane may reduce the cost of cultivation since large farm size had relatively good scope for mechanization which may reduce the cost of human labour resulting in reduced cost inefficiency.

Keywords: Sugarcane, Stochastic cost frontier model, cost efficiency, age, educational level

ROLE OF SECONDARY METABOLITES AS DEFENSES AGAINST BRUCHID ATTACK IN MUNGBEAN [*VIGNA RADIATA* (L.) WILCZEK]

SANHITA GHOSH*, ANINDITAROY AND SABYASACHI KUNDAGRAMI

DEPARTMENT OF GENETICS AND PLANT BREEDING, INSTITUTE OF AGRICULTURAL SCIENCE, UNIVERSITY OF CALCUTTA, KOLKATA-700019, WEST BENGAL, INDIA

Mungbean [*Vigna radiata* (L.) Wilczek] is the important and inexpensive protein rich pulse crop of Indian origin referred as poor man's meat. Bruchids (*Callosobruchus maculatus*) (Coleoptera: Bruchidae) are the major polyphagous storage pest. It causes deterioration of the quality and quantity of mungbean seeds which directly affect from farmers agriculture to commercial economy as well as the human health. As the storage problem due to bruchid infestation is one of the major constraints for mungbean production. Therefore, this problem must be sorted out. Secondary metabolites particularly the antinutritional factors create some obstacle to nutritional utilization in human life. In view of this fact, we aim to screen the bruchid susceptible and resistant mungbean genotypes and establish their relationship with secondary metabolites. Fifty-two mungbean genotypes were infested with two pairs of male and female bruchids into B.O.D condition for

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maintain the humidity and temperature. Four resistant and ten bruchid susceptible mungbean genotypes were recorded as per the bruchid susceptibility index (BSI) by Dobie, 1974. Then, assessed the secondary metabolites of resistant and susceptible mungbean genotypes. A negative relationship recorded between the anti-nutritional factors and the BSI and revealed that higher content of secondary metabolites observed in the resistant genotype. So, it will be hypothesized as presence of higher amount secondary metabolites defenses the intensity of bruchid.

Key words: Mungbean, Bruchid, Susceptible, Resistant, Secondary metabolites.

DEVELOPMENT OF ICE-CREAM BY USING JACKFRUIT PULP

SWAPNA B. GAIKWAD, YOGESH N. PATIL, NIKHIL R. SONONE,

DEPARTMENT OF ANIMAL HUSBANDRY AND DAIRY SCIENCE, COLLEGE OF AGRICULTURE, SONAI, NEWASA (MH)414105

MGM, NKCA, GANDHELI, AURANGABAD, (MH)431007

SDMVM'S, GEORAITANDA, AURANGABAD.(MH)431007

Ice-cream was prepared from buffalo milk standardized at 6 per cent fat. Initially the type of jackfruit was selected by preparing ice-cream using '*Barka*' and '*Kappa*' type and it was found that addition of the JP of *Barka* type had more scores for all the sensory attributes over the *Kappa* type. Subsequently the level of jackfruit pulp (JP), levels of sugar and level of stabilizer were optimized. It was observed that maximum score for flavour, colour and appearance, body and texture, sweetness and overall acceptability were observed for the ice-cream containing 15% jackfruit pulp. Further increase in level of jackfruit pulp resulted in lower overall acceptability score. Simultaneously when sugar was added @ 13, 15 and 17 per cent of ice-cream mix the overall acceptability score for 15 per cent sugar level was maximum, (8.18). Subsequently, the ice-cream was prepared using three different stabilizers with 15 per cent JP ice-cream. The maximum sensory score was observed for ice-cream with 0.1 per cent carrageenan stabilizer. Overall acceptability score of 0.1 per cent carrageen was maximum (8.12) as compared to other stabilizer sodium alginate and CMC. The optimized product had 8.00 ± 0.10 , 8.05 ± 0.06 , 8.28 ± 0.08 , 8.20 ± 0.09 and 8.12 ± 0.04 scores for flavour, colour and appearance, body and texture, sweetness and overall acceptability respectively. The ice-cream prepared by optimized formulation showed 11.33 ± 0.12 , 3.39 ± 0.05 , 7.80 ± 0.29 , 16.25 ± 0.26 , 24.05 ± 0.23 , 0.92 ± 0.01 , 39.65 ± 0.45 , 0.30 ± 0.01 , 6.14 ± 0.02 , 27.50 ± 0.55 and 76.20 ± 0.22 per cent, fat, protein, reducing sugar, non-reducing sugar, total sugar, ash, total solid, acidity, pH, melting rate and overrun, respectively. The cost of experimental jackfruit ice-cream was found to be Rs. 82.43/lit. **Key word**:- Jackfruit, ice-cream.

MULTIVARIATE ANALYSIS IN QPM HYBRIDS FOR GRAIN YIELD AND ITS ATRRIBUTING TRAITS

VASKAR SUBBA^{1*}, ROSHAN SUBBA¹, AMITAVAGHOSH², AND SABYASACHI KUNDAGRAMI² ¹DEPARTMENT OF SEED SCIENCE AND TECHNOLOGY,INSTITUTE OF AGRICULTURAL SCIENCE, ²DEPARTMENT OF GENETICS AND PLANT BREEDING, INSTITUTE OF AGRICULTURAL SCIENCE, UNIVERSITY OF CALCUTTA, KOLKATA-700019

This study was carried out to evaluate fifty-four F1 Quality Protein Maize (QPM) hybrids in two rabi seasons (2016-2017 and 2017-18) at the Experimental Farm of University of Calcutta, Baruipur, South 24 Paraganas. Data were recorded on twelve agro-morphological traits i.e, days to tasseling 50 %, days to silking 50%, plant height (cm), ear height (cm), cob length (cm), cob diameter (cm), number of grain rows per cob, number of grains per row, number of grains per cob, 100 grain weight, single cob weight, grain yield per plant. All the traits were analysed using multivariate statistical analysis. Most of the evaluated traits exhibited a wide range of variation. Cluster analysis using UPGMA method grouped the hybrids into four clusters. The component of maize hybrids among different clusters was varied from forty to one hybrid. The maximum number of hybrids i.e., 40 is found in cluster I followed by cluster IV comprising of 12 hybrids. Cluster IV showed the maximum mean value for cob length (cm), cob diameter (cm), number of grains per row, number of grains per cob and single cob weight. Principal component analysis revealed that the first three main PCAs accounted 78.56% of the total variation among hybrids. PC1 accounts for maximum variability in the data with respect to succeeding components. **Keywords**: Agro-morphological, QPM hybrids, Principal Component Analysis, Cluster Analysis

EFFECT OF SHADING ON GROWTH, DEVELOPMENT AND REPRODUCTIVE BIOLOGY OF MAJOR WEED SPECIES OF WINTER SEASON

SUDERSHAN MISHRA¹, S K GURU

DEPTT. OF PLANT PHYSIOLOGY, CBSH, GBPUA&T, PANTNAGAR

Light plays a major role through its direct effects on morphology and biomass production by plants. Both crops and weeds compete for light by shading each other. Therefore the effects of shading on growth and development of both crops and weeds will determine their competitive ability. To analyse the implications of shade on weed biology, an experiment was conducted in winter season 2017 to evaluate the effects of shading on growth, development and reproductive biology of major weed species of winter season. The treatments included full sunlight, 55% shade and 75% shade. Data on phenology, biomass partitioning and reproductive biology was recorded for all the species. The total duration was delayed by more than two weeks under 55% shading and by three-four weeks under 75% shading for all the weeds, as a result of cumulative increase in vegetative, reproductive as well as time taken from flowering to maturity. Plant height was doubled within two weeks after shading and was enhanced by more than 30cm and 38cm under 55% and 75% shading, respectively. Total aboveground dry matter accumulation decreased by more than 80% under shading and almost two-three fold proportion of dry matter was partitioned towards leaves. Concomitant variation in SLA, RGR, NAR and LAR indicated adaption to shade at whole plant level. The lowest decrease in maximum NAR and RGR was observed in *Polypogon* and *Solanum*, expressing their high competitive ability over other weeds under study. Number of seeds per plant was reduced by 67% under shading as a consequence of proportional reduction in number of fruits/inflorescences. However the number of seeds per fruit remained fairly constant. Chlorophyll a/b ratio was also found to be reduced under shading.

Key words: Shading, Light, Weed, Growth, Polypogon

ADVERSE EFFECT OF DIFFERENT TREATMENTS OF CHROMIUM ON GROWTH PARAMETERS OF SORGHUM BICOLOR (L.) SWEETY SIHAG^{*}, AND U. N. JOSHI

DEPARTMENT OF CHEMISTRY AND BIOCHEMISTRY, CCS HARYANA AGRICULTURAL UNIVERSITY, HISAR (HARYANA) - 125004, INDIA

The environmental factor effects plant productivity and among them heavy metal stress reduces it. Agricultural soils occasionally contain phytotoxic levels of heavy metals, but more frequently they accumulate it as a result of various developmental and economic activities of man-kind. Certain metals such as iron (Fe), copper (Cu) and zinc (Zn) are considered as essential nutrients to plants and are needed for photosynthesis and as cofactors for many enzymes. A pot experiment was conducted to determine the effects of varying Cr (VI) levels [0.0–4.0 mg Cr (VI) kg⁻¹ soil in the form of potassium dichromate] on the quality parameters and mineral content of sorghum. The present investigation showed that the quality parameters includes protein content, chlorophyll content, and IVDMD (*In vitro dry matter digestibility*) content are estimated at different growth stages, *i.e.* 35 DAS, 70 DAS and 90 DAS (Days after sowing) that were adversely affected with an increase in Cr (VI) levels from 0.0 to 4.0 mg Cr (VI) kg⁻¹ soil. protein content, chlorophyll content and IVDMD content decreased with increase in chromium concentration. High concentration of chromium adversely affects the plant growth and affects its nutritive value also.

Key words; Sorghum, Chromium Content, IVDMD, Chlorophyll .

DETERMINATION OF AGRICULTURAL MECHANIZATION PARAMETERS FOR CENTRAL REGION OF UTTAR PRADESH, INDIA

TARUN KUMAR MAHESHWARI AND ASHOK TRIPATHI

FARM MACHINERY AND POWER ENGINEERING, VSAET, SAM HIGGINBOTTOM UNIVERSITY OF AGRICULTURE, TECHNOLOGY AND SCIENCES (SHUATS), ALLAHABAD-211 007, UP, INDIA

Uttar Pradesh is situated in northern India. It covers 243290 Km². The state is also divided into 9 agro-climatic zones. The central agroclimatic zone of Uttar Pradesh contains 14 districts. Out of 14 districts 4 districts were selected for the study Agriculture mechanization also helps in improving safety and comfort of the agricultural worker, improvements in the quality and value addition of the farm produce and also enabling the farmers to take second and subsequent crops making Indian agriculture more attractive and profitable. There is a linear relationship between availability of farm power and farm yield. In India, there is a need to increase the availability of farm power from 2.02 kW per ha (2016-17) to 4.0 kW per ha by the end of 2030 to cope up with increasing demand of food grains. The average size of operational holding has declined to 1.08 ha in 2015-16 as compared to 1.15 in 2010-11. The farm mechanization indicators and their variability among different districts of central zone were studied. It can be seen that Kannauj and Pratapgarh are significantly more mechanized in comparison to Hardoi and Etawah on the basis of mechanization index and power availability. Also, power availability of Kannuj is significantly highest in comparison to other 3 districts. The Mechanization index, Power availability, Total energy, Mechanical energy, are highest in Kanuuj district significantly in comparison to Hardoi, Etawah and Pratapgarh ie 0.972, 3.29 kW/ha, 4901.40 kWh/ha, and 4810.67 kWh/ha respectively but Human energy is highest in Hardoi district i.e. 897.75 kWh/ha in comparison to other three districts. The cropping intensity of Kannuj district is 260% which is less than Hardoi but more than Etawah and Pratapgarh. The average value of Mechanization index, Power availability, Total energy, Mechanical energy in central zone of UP are 0.9497, 2.18 kW/ha, 2450 kWh/ha, 2351.86 kWh/ha, 97.89 kWh/ha respectively

Keywords: Mechanization Index, Power Availability, Total Energy, Mechanical Energy, Cropping Intensity.

DNA MARKER BASED EVALUATION OF AROMATIC RICE GENOTYPES OF CHHATTISGARH REGION SUNITA SINGH¹ ARCHANA S. PRASAD¹ SONAM S. KALE² AND MADAN JHA

DEPARTMENT OF PLANT MOLECULAR BIOLOGY AND BIOTECHNOLOGY IGKV, RAIPUR - 492012, CHHATTISGARH, INDIA

DEPARTMENT OF VEGETABLE SCIENCE IGKV, RAIPUR (C.G.)

Among different strategies to detect aroma in rice, fragrance linked -DNA markers have potential to improve the efficiency and precision being simple, inexpensive and co-localized with aroma gene. In this study the F₂ plants of two mapping population developed by crossing aromatic parent Tarunbhog with local non aromatic variety safri17 and aromatic variety Dubraj were evaluated for a set of 13 yield attributing traits and further, we evaluated the discrimination ability of 29 gene tagged functional DNA marker for genotypic selection of aromatic plants. All the F2 plants were categorized into two additional categories indicated involvements of more than two gene .out of 29 markers 2 were showed polymorphism.

Key words: Aroma, functional DNA marker

ADOPTION AND IMPACT OF SYSTEM OF RICE INTENSIFICATION ON FARM INCOME OF GUMLA, JHARKHAND TULIKA KUMARI¹, S.P. SINGH¹ AND NASIM AHMED¹

¹RAJENDRA PRASAD CENTRAL AGRICULTURAL UNIVERSITY, PUSA, SAMASTIPUR

System of Rice Intensification is a new system of rice cultivation for increasing rice productivity with a comprehensive package of practices involving less seed, water, chemical fertilizers and pesticides. It is one of the most effective technologies which will enhance rice production. To meet the increasing demand of food grains, it is important to increase the production and this is possible through adoption of technologies, which can enhance the production as well as return. Therefore, the present paper has focused on identifying determinants of System of Rice Intensification (SRI) adoption decision and examining the impact of adoption on farm income. System of Rice Intensification (SRI) is one of the important methods which can increase the rice production and thus food production. This increased production is able to increase return from the produce and improve the farmers' economic condition. In this way, adoption of SRI method has potential to increase the farmers' income. The primary data was collected through a pre tested schedule from 80 randomly selected respondents in Gumla district for the present study, in which 40 were adopters and 40 were non adopters. The analysis was done by using logit and OLS regression model. The logit result indicated that adoption decision of household has been determined by farm size, membership to an agriculture association, age of household head and off farm participation of household head. The regression result also

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revealed that SRI adoption has a positive and significant effect on farm income by which adopters are getting more benefit than nonadopters.

Key words: System of Rice Intensification, Logit, OLS

EFFICACY OF ORGANIC AMENDMENTS AND HYDROPHILIC POLYMER HYDROGEL ON SUNFLOWER PRODUCTION IN *KHARIF* SEASON

¹VARSHA R. BHOPLE, ²SAMADHAN D. JADHAV AND ³VISHAL O. KOHIRE PATIL ^{1,3}DEPARTMENT OF AGRONOMY, MGM, NKCA, GANDHELI, AURANGABAD (MH)431007 ²VIVEKANAND COLLEGE OF AGRICULTURE, HIWARA BK (MH)443301

The present investigation "Efficacy of organic amendments and hydrophilic polymer hydrogel on sunflower production in *kharif* season" was carried out at the farm of Oilseed Research Unit, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola during *Kharif* season of 2016-17. All the yield attributes such as diameter of disc (cm), weight of disc (g), number of filled seed, total number of seed disc-¹, 100 seed weight and seed weight plant⁻¹ were significantly affected by different treatments. All these attributes were significantly highest in case of RDF + Vermicompost @ 2.5 t in seed furrows which was significantly superior over RDF + Fly ash @ 2.5 t ha⁻¹ in seed furrows, RDF + 2.5 t FYM ha⁻¹ in seed furrows, RDF + 5 t FYM ha⁻¹ spreading across field. Significantly highest seed yield (2153 kg ha⁻¹), straw yield (4218 kg ha⁻¹) and oil yield (919 kg ha⁻¹) was recorded with RDF + Vermicompost @ 2.5 t in seed furrows. RDF + Vermicompost @ 2.5 t in seed furrows and maximum B:C ratio (3.20) was observed with RDF. In spite of higher GMR reported by vermicompost @ 2.5 t ha⁻¹ in seed furrows. The highest uptake of NPK was also noticed with treatment RDF + Vermicompost @ 2.5 t ha⁻¹ in seed furrows. The maximum available NPK was also observed in the same treatment.

TRANSGRESSIVE SEGREGATION STUDIES IN OKRA (ABELMOSCHUS ESCULENTUS (L.) MOENCH) TOTRE A. S. 1 AND R. D. NIMBALKAR 2

COLLEGE OF AGRICULTURE, PUNE-5 (M.S.)

The present investigation entitled "Transgressive Segregation Studies in Okra (Abelmoschus esculentus (L.) Moench)" was undertaken with the objective to study the extent of genetic variability and its components, to study variants in segregating generation and identify superior cross combination in F₂ generation. The material consisted, F₂ of three crosses, four parents and two checks for studying the variability; for transgressive segregation studies F₂ of three crosses Hisar Navin x P-8 (Cross 1), HRB-142 X Arka Abhay (Cross 2), Hisar Navin x Arka Abhay (Cross 3) were involved. The materials were evaluated in randomized block design with three replication during kharif 2015 at Botany Research Farm, Division of Botany, College of Agriculture, Pune. Observations were recorded on ten characters viz., days to 50% flowering, plant height at first picking, internodes per plant, branches per per plant, days to 1st picking, fruits per plant, average fruit length, average fruit girth, locules per fruit and green fruit yield per plant. Significance of treatment mean of squares for ten characters studied revealed the presence of considerable amount of variability in F2's of three crosses, four parents and two checks. A wide range of variability was observed in respect of days to 50% flowering, plant height at first picking, days to 1st picking, fruits per plant and green fruit yield per plant. Maximum variability was contributed by green fruit yield per plant. The genotypic coefficients of variation (GCV) were slightly lower than the phenotypic coefficients of variation (PCV) for almost all the characters under studies. The character days to 1st picking showed very high estimates of broad sense heritability and the characters days to 50% flowering, plant height at first picking show medium broad sense heritability. The heritability (b.s.) ranged from 0.91% (Average fruit length) to 83.50% (Days to 1st picking). Almost all the character show low genetic advance and maximum genetic advance found in plant height at first picking (8.28). The minimum genetic advance as was observed for average fruit length (0.01). The high to moderate genetic advance of percent mean was recorded for the character branches per plant (43.79) and plant height at first picking (15.00). The lowest genetic advance of percent means for days to 1st picking (9.06) and remaining character. The studies on transgressive segregation led to isolation of desirable transgressive segregants for ten characters in all three crosses. The proportion of transgressive segregation was found to be 12.33% to 24.67% for green fruit yield per plant. In most of the segregants, green fruit yield per plant of better parent was transgressed simultaneously with transgression of one or more characters. From the studies on transgressive segregation, together it could be inferred that selection of transgressants for, days to 1st picking, branches per plant, plant height at first picking, internodes per plant and average fruit length will lead to increase in green fruit yield and there was simultaneous transgression for one or more of these component with green fruit yield per plant. Based on studies. more number of transgressive segregants were observed in Hisar Navin x Arka Abahy. In case of characters studied green fruit yield per reported maximum number trangressive segregants followed by plant height at first picking, average fruit length, days to 50% flowering, fruits per plants plant. The most promising transgressive segregants possessing higher per cent performance for green fruit yield per plant and one or more desirable traits were F2 Plant No. 283 of cross Hisar Navin x Arka Abhay, Plant No. 16 of cross HRB-142 X Arka Abhay and Plant No. 42 of cross Hisar Navin x P-8. On the basis of observed high values of transgressive segregants, it could be concluded that when desired intensity of characters is not available in the parents, transgressive breeding could be successfully utilised to extend the limit of expression of the characters for further improvement in okra.

BIOEFFICACY OF QUINCHLORAC HERBICIDE AGAINST WEEDS IN TRANSPLANTED RICE ON ECONOMICS V. EKKA, N. TIWARI, S. KUJUR, D. NAYAK AND MADAN JHA DEPARTMENT OF AGRONOMY, INDIRA GANDHI KRISHI VISHWAVIDYALAYA, RAIPUR-492012, CHHATTISGARH. DEPARTMENT OF VEGETABLE SCIENCE, INDIRA GANDHI KRISHI VISHWAVIDYALAYA, RAIPUR-492012, CHHATTISGARH.

The Field experiment was conducted during Kharif season 2015 at Research Cum Instructional farm of Indira Gandhi Krishi Vishwavidyalaya, Raipur C.G. to evaluate the quinchlorac herbicide against weeds in transplanted rice. Ten weed control treatments were laid out in randomized block design with three replications. The result revealed that the major weed species in experimental site were *Cyperus iria L, Cyanotis axillaris L, Alternanthera triandra L, Echinochloa colona L, Ischaemum rugosum Salisbury*, and *Caesulia axillaris Roxb*. The highest gross return, net return and benefit cost ratio was obtained under treatment quinchlorac 250 g/l SC @ 250 g ha⁻¹

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+ bispyribac sodium (10 % SC) @ 20 g ha⁻¹ (T₅) followed by quinchlorac 250 g/l SC @ 250 g ha⁻¹ + ethoxysulfuron (15 % WP) @ 15 g ha⁻¹ (T₄) and lowest gross return was noted under control (T₁₀). **Keywords**:-Transplanted Rice, Herbicide, gross return, net return and benefit cost ratio

STUDIES ON INSECT DIVERSITY IN CKICKPEA (CICER ARIETINUM LINNAEUS) ECOSYSTEM

VEER VIKRAM SINGH¹, NEERJA AGRAWAL¹ AND NEERJA GUPTA² ¹DEPARTMENT OF ENTOMOLOGY, C.S.A. UNIVERSITY OF AGRICULTURE AND TECHNOLOGY, KANPUR (U.P.) ²DEPARTMENT OF CHEMISTRY, A.N.D.N.N. COLLEGE, KANPUR (U.P.)

Pulses are the cheapest source of protein containing essential amino acids required for the proper growth and development of human body. Chickpea, popularly known as gram is attacked by a number of insect pests in the field. Biotic and abiotic factors affect incidence of pests as well as their natural enemies in chickpea crop. The present investigations would throw a light on effect of environmental factors in chickpea, biological control agents such as egg parasites/ parasitoids and their potential role in IPM. Therefore, a study on the insect diversity in chickpea ecosystem was carried out in the field at Student Instructional Farm, C.S.A. University of Agri.&Tech., Kanpur during winter of 2015-2016. Altogether four insect-pests Helicoverpa armigera (Hubner), Agrotis ipsilon (Hufnagel), Spodoptera litura (Fabricius) and Odontotermes obesus (Rambur) and two natural enemies of chickpea pod borer Trichogramma chilonis (Ishii) and Campoletis chlorideae (Uchida) have been recorded in the chickpea. Among these pests of chickpea, gram pod borer was found as key pest in the field. Gram pod borer, H. armigera appeared first in the 51st SW (Standard week) during mid-December with its initial intensity of 0.25 larvae m⁻¹ row which increased in subsequent weeks up to 8th SW and touched the peak population of 13.00 larvae m⁻¹ row during 9th SW. It showed positive correlation with respect to maximum temperature while negative correlation with minimum temperature, relative humidity and rainfall. Larval parasitization of H. armigera by the parasitoid, C. chlorideae was observed predominantly in chickpea ecosystem as compared to egg parasitoid, T. chilonis. Host population and weather factors played significantly positive role in the parasitization. It was observed that 7th SW with maximum temperature of 30.4 °C, minimum temperature of 11.7 °C and RH of 75.0 per cent was most conducive factor for the larval parasitization. As regards the biotic factors of gram pod borer, H. armigera exhibited a significant positive correlation with T. chilonis, which indicate important role in suppressing the pest population to some extent. Key words: Helicoverpa armigera, Trichogramma chilonis, Campoletis chlorideae, Chickpea.

NITROGEN USE AND MANAGEMENT UNDER CONSERVATION AGRICULTURE

VIKAS KUMAR, NEHA, N. SAINI, M.S. JATANA, M. KAKRALIYA AND A. KAUR CHAUDHARY CHARAN SINGH HARYANA AGRICULTURAL UNIVERSITY, HISAR, HARYANA ICAR- CENTRAL SOIL SALINITY RESEARCH INSTITUTE, KARNAL, HARYANA

Majority of Indian soils are inherently poor in nitrogen (N) supply due to their geographic location in subtropical/tropical climates that do not encourage maintenance and accretion of soil organic matter. Sustainable and economically viable crop production in these N-deficient areas, therefore, depends largely on N application in adequate amounts through external sources, in addition to use of other agri-inputs and adoption of appropriate crop-management practices. The dynamic nature of N and its propensity for loss from soil-plant systems further creates a unique and challenging environment for its efficient management. Recovery of applied N in crop plants is extremely low (usually less than 50%), and its enhancement continues to be a major challenge. Research on improving nitrogen use efficiency (NUE) during past decades focused on a better synchronization between the N supply and crop N demand as well as minimizing N losses. Nonetheless, NUE continues to be extremely low, and is presently one of the priority areas for soil fertilizer management research. Balanced fertilization, integrated plant nutrient supply, inclusion of legumes, precision N management and N management under conservation agriculture are the key practices in increasing the NUE. Integrated plant nutrient system (IPNS) is one of the promising methods involving conjoint use of different nutrient sources appeared a promising strategy for sustaining high yields, restoration of soil health, and improvement in fertilizer use efficiency. Precision N management (PNM) refers to N management strategies that encourage better utilization of applied N, enhance NUE and minimize N losses. The NUE could be optimized by bringing in precision management following '4 R' principle, which implies right fertilizer source, right rate, right time, and right method of placement. The three pillars of conservation agriculture (CA), i.e., minimum soil disturbance, permanent organic soil cover, and diversified crop rotations including legumes, do influence the soil nitrogen dynamics. Adoption of other fertilizer best management practices, such as timely sowing/planting, adoption of recommended crop protection measures, and timely weed control, are extremely essential for enhancing NUE in crops and cropping systems.

Key words: Nitrogen use efficiency, IPNS, N-dynamics, conservation agriculture.

CORRELATION AND PATH COEFFICIENT ANALYSIS IN RICE (ORYZA SATIV L.) UNDER SODIC SOIL

VISHWANATH PRATAPYADAV¹, P.K. SINGH², KANHAIYA LAL¹, VIKASH YADAV¹, DURGA PRASAD¹, AJEET JAISWAL¹ AND ROHIT KUMAR¹

DEPARTMENT OF GENETICS AND PLANT BREEDING, CSAUA&T, KANPUR (UP)^{1,}

DEPARTMENT OF GENETICS AND PLANT BREEDING, NDUA&T, KUMARGANJ, FAIZABAD(UP)².

Rice (*Oryza sativa* L.) belongs to poaceae family. It has been cultivated as a major crop from ~11,500 years and it currently sustains one half of the world population and its native is in tropical and subtropical south-eastern Asia and Africa. Rice is the principal source of food for more than one third of the world's population. India is an important centre of rice cultivation. The rice harvesting area in India is the world's largest. The two major rice varieties grown worldwide today are Oryza sativa indica and Oryza sativa japonica. According to research studies they owe their origins to two independent events of domestication thousands of years ago. The crosses were 44 treatments (10 lines + 3 tester + 30 F₁'s including one check variety, (Narendra Usar Dhan- 3). The experiment was made during *Kharif*, 2016 at research farm of Genetics & Plant Breeding and the hybrids along with parental lines and check varieties were evaluated during *Kharif*, 2017 at Student Instructional Farm and Genetics and Plant Breeding form of NDUAT, Kumarganj, Faizabad. The experiment was

conducted in randomized block design along with three replications. In each block 44 entries were accommodated. The characters studied were days to 50% flowering, plant height (cm), flag leaf area (cm²), panicle bearing tillers per plant, panicle length (cm), grains per panicle, spikelet fertility (%), Chlorophyll Content(SPAD Value), 1000- grains weight (g), biological yield per plant (g), harvest-index (%) and grains yield per plant (g). The phenotypic and genotypic correlation coefficients between different characters which are exhibited grain yield per plant very strong positive association with biological yield, panicle bearing tillers per plant, chlorophyll content, grains per panicle, spikelets fertility, harvest-index and 1000-grain weight at phenotypic and genotypic level. The path-coefficient analysis was carried out at genotypic as well as phenotypic level of biological yield per plant followed by harvest index exerted very high positive direct effects on grain yield at both phenotypic as well as genotypic level.

Key words: Correlation and path coefficient analysis in rice

GENETIC DIVERGENCE STUDIES IN FORAGE SORGHUM (SORGHUM BICOLOR L. MOENCH)

VIKASH YADAV¹, S.K. SINGH², ROHIT KUMAR³, SHARDULYA SHUKLA⁴ AND PUSHKAR DIXIT⁵ 1&3 DEPARTMENT OF GENETICS AND PLANT BREEDING, CSAUA&T, KANPUR (U.P.), ² DEPARTMENT OF GENETICS AND PLANT BREEDING, SVPUA&T, MEERUT, (U.P.), ⁴RESEARCH SCHOLAR, DIHAR, DRDO, BASE LAB CHANDIGARH.

⁵ DEPARTMENT OF HORTICULTURE, SVPUA&T, MEERUT, (U.P.).

Sorghum is the most important food and fodder crop of dry land agriculture. Sorghum grains are important as food and as livestock feed. The stem and foliage are used as a green fodder, hay, silage and pasture. Sorghum is an important source of animal feed and fodder. It is the fifth major cereal crop in the world after wheat, rice, maize and barley. Increase, it ranks 5th and accounts for 3.5% of total cereal grain production. Involving thirty five genotypes was undertaken to examine the genetic variability, heritability, genetic advance and genetic divergence. All the thirty five forage sorghum genotypes were tested in randomized block design (RBD) with three replications during Kharif 2017. Observations were recorded for days to 50% flowering, plant height, leaf length, leaf breadth, leaf area, stem girth, number of leaves per plant, leaf stem ratio, total soluble solids and green fodder yield. Analysis of variance revealed substantial amount of variability among the genotypes for all the characters under study, indicated wide spectrum of variability among the genotypes. High heritability coupled with high genetic advance were observed for these traits. These traits may be considered as important yield component in sorghum. Leaf area displayed high order of direct effect on green fodder yield followed by leaf breadth and leaf length suggested that these characters should be used for selection of desirable genotype after hybridization between the accessions for creating wide spectrum of favorable genetic variability for improvement of green fodder yield in sorghum. Genotype from the same geographical region fell into different clusters and vice-versa. This suggested that selections of parents for hybridization should be on genetic diversity rather than on the geographical areas. The percent contribution of leaf stem ratio followed by green fodder yield, plant height and number of leaves per plant contributed most towards genetic divergence. Genetic divergence study suggested that crosses between the genotypes cluster IV (HJ-513 and UP Chari-1) and cluster V (CSV-15 and SPV-815) and genotypes of cluster VI (Pant Chari-4) for getting better hybrid vigour in F1 or better hybrids and also for good recombinants in segregating population.

Key words: Genetic Divergence, *kharif* forage sorghum

EFFICACY OF NEEM BASED PLANT PRODUCTS AGAINST LINSEED BUD FLY (D. LINI BARNES).

VINAY PRADHAN, GP PAINKRA*, VK SANDILYA, JK SAHU

DEPARTMENT OF ENTOMOLOGY IGKV, RMD COLLEGE OF AGRICULTURE AND RESEARCH STATION, AMBIKAPUR-497001(C.G.)

The studies on Efficacy of Neem based plant products against linseed bud fly (D. lini Barnes) were conducted at Rajmohini Devi Collage of Agriculture and Research station, Ambikapur during Rabi seasons of 2017-18. Efficacy of some Neem based plant products viz., Neem leaf extract, Neem seed kernel extract, Neem seed extract and Nimazaal at different concentrations was determined against linseed bud fly (D. lini Barnes). The efficacy of different neem based formulation were tested against D. lini Barnes on linseed crop during 2017-18. viz. NSKE @ (5%). NSKE @ (3%), Nimazal @ (5%), NSE @ (5%), NSE @ (3%), NLE @ (5%), NLE @ (3%) and untreated control. Bud fly infestation ranged from 18.37 to 27.61 per cent in different neem based formulations. NSKE 5 per cent with bud infestation of 18.37 per cent was most effective against linseed bud fly. It was at par with Nimazal 5 per cent and NSKE 3 per cent having bud damage of 19.07 and 20.12 per cent, respectively, but differed significantly from Neem seed extract 5 and 3 per cent, and Neem leaf extract 5 and 3 per cent with 20.80, 22.41, 23.24, and 27.61 per cent bud infestation, respectively. Neem leaf extract 3 per cent with significantly highest bud damage of 27.61 per cent was least effective against bud fly among neem based formulations as against 33.07 per cent bud damage in untreated control.

Keyword: Linseed, Neem and bud fly

EXPLOITATION OF HETEROSIS FOR YIELD AND YIELD ATTRIBUTING TRAITS IN SPINE GOURD (MOMORDICA DIOICA ROXB)

VIVEK KUMAR SANDILYA^{1*}, ANANDI KINDO³, SWAPNIL BARUA² GAJALA AMEEN¹ AND J. K. TIWARI¹ ¹SECTION OF GENETICS AND PLANT BREEDING, RMD COLLAGE OF AGRICULTURE AND RESEARCH STATION, **IGKV, AMBIKAPUR (C.G.) – 497001**

²SECTION OF AGRONOMY, RMD COLLAGE OF AGRICULTURE AND RESEARCH STATION, IGKV, AMBIKAPUR (C.G.) ³SECTION OF ENTOMOLOGY, RMD COLLAGE OF AGRICULTURE AND RESEARCH STATION, IGKV, AMBIKAPUR (C.G.) Heterosis for quantitative characters in 31 spine gourd genotypes (10 parents and 21 F₁) was investigated during June to September 2017-18. Analysis of variance revealed highly significant differences among the parents and hybrids for 10 characters studied. Considerable coefficient of variation were observed for Days to first flowering, Days of first flowering node, number of stem per plant, fruit shape, ovary length, ovary diameter, fruit length, single fruit weight, number of fruit per plant, and fruit yield per plant indicating the scope of selection for those characters. The characters like ovary length, ovary diameter, fruit length, single fruit weight,

number of fruit per plant, fruit yield per plant contributed the maximum variability towards divergence among spine gourd genotypes. Heterosis study depicted that the crosses. Cross NDM-5 x AJSG-2 showed desirable heterotic cross over mid parent and NDM-5 x AJSG-2 for better parent for single fruit weight. Cross RMDSG-4 X IK-1 showed desirable better parent heterotic cross over mid parent and NDM-2 x CK-2 for better parent and RMDSG-4 X IK-1 for commercial check for number of fruit per plant. Cross RMDSG-4 X AJSG-2 showed desirable heterotic cross over mid parent and crosses NDM-5 x AJSG-2 for better parent and RMDSG-4 X AJSG-2 for commercial check for fruit yield. Therefore the above tested cross combinations could be utilized for isolating superior segregates for these traits or could be exploited in isolating pure line varieties based on performance in spine gourd.

Key words: Better Parent, Mid Parent, Commercial Check, Heterosis, Momordica dioica.

SITE SPECIFIC NUTRIENT MANAGEMENT FOR CROP YIELD MAXIMIZATION USING TWO SOIL TYPES OF BILASPUR DISTRICT OF C.G. ON GRAIN AND STRAW YIELD YUSHMA SAO, GAJENDRA SINGH AND MADAN KUMAR JHA

BTC COLLEGE OF AGRICULTURE AND RESEARCH STATION, BILASPUR (C.G.)

The field experiment was conducted A pot experiment was carried out at the Department of Soil Science and Agricultural Chemistry, BTC College of Agriculture and research Station, Bilaspur, during Kharif season 2015-16. On the basis of 1st season results farmer's field demonstration was also carried out at field of farmer's (from where bulk of soils were collected for pot experiment) during Rabi season 2015-16. The soils used for pot experiment were two type i. e. Inceptisol and Vertisol. Both the soils were collected from two different locations of Bilaspur district. Collected soils were air dried and filled in cemented pots. The treatments constituted with application of all nutrients applied at optimum level known as All (SSNM dose) while in others, one of the nutrient elements from all the nutrient treatments (All) was omitted. There were eleven treatments for each type of soil and three replications with completely randomized design. All treatments were common for both the soils except omission of Fe and Mn in case of Vertisol and omission of Ca and Mg in case of Inceptisol were kept keeping the concept of soil reaction. After addition of all treatments, rice (MTU-1010) was transplanted in three hills/pot with 2-3 seedlings in each hill. In eleven treatments. Grain and straw yields of rice in Vertisol were significantly reduced with the omission of N, P and S in comparison to the treatment T1 that received all the nutrients. The yield reductions were more pronounced with N and P omission pots (43.2 %, 41.7 % and 34.1 %, 31.8 % respectively). Reductions in grain and straw yields in S omitted pots were 11.3 % and 10.6 %, respectively. And Grain and straw yields of rice in Inceptisol were significantly reduced with the omission of N, P, and S in comparison to the treatment (T1) that received all the nutrients. The yield reductions were more pronounced with N and P omission (42.8 %, 38.9 % and 32.8 %, 31.5 % respectively). Reductions in grain and straw yields in S omitted pots were 13.9 % and 12.5 %, respectively. Keywords: Inceptisol, Vertisol, Nutrients, Straw

VERTICAL FARMING-GROW FOOD EVERYWHERE ZIOM ADAM MICHAEL* AND RAMAWATAR MEENA DEPARTMENT OF SOIL SCIENCE AND AGRICULTURAL CHEMISTRY, BANARAS HINDU UNIVERSITY, VARANASI-221005, INDIA

Many have wondered for years if vertical farming is really the answer to the shortage of food in the world. The concept of vertical farming might seem to many startups, it is an ingenious method to produce food in environments where arable land is unavailable or rare. Vertical Farming is a revolutionary and more sustainable method of agriculture. This is an innovation in the field of agriculture with sustainability as its motto is making more and more heads turn today with its eco-friendly methods and making the possibility of farming real in difficult environs. It is a theoretical concept that may offer panacea to our food production problem in the future. Vertical farming includes hydroponics,aeroponics,aquaponics,local aero farms-smart vertical farming innovations, plant scrapers,Verti crop, modular farms, cubic farming systems-the next generation sustainable farming system, zip grow, bowery-the most technologically sophisticated commercial indoor farm, sky farm-wind powered, sky greens-first hydraulic farm. Vertical farms could enable every country in the world regardless of climate or agricultural land to be able to grow food in an efficient manner. They could save energy, water, reduce toxins, provide new employment opportunities, restore ecosystems and much more. It is believed that farming has been blight on the natural land scape for 1,20,000 years and that buy producing food in vertical farms, it will allow us for the first time to feed everyone on the earth and still return land to its original ecological condition.By the time 2050 rolls around 80% of the total world's population will dwell in an urban setting. With more and more people focused on healthyorganic food bought locally, the demand is even greater to bring food production closer to city. It doesn't eliminate traditional rural farming but merely to reduce the strain put on the land. Keywords: Environs, hydroponics, aeroponics, aquaponics.

SESAME GENIC SSR MARKERS FOR ASSOCIATION MAPPING OF OIL CONTENT IN SESAME (SESAMUM INDICUM L.)

ADIL IQBAL ^{1,2*}, UDAYAN BHATTACHARYYA ³, RUMANA AKHTAR¹, AND TAPASH DASGUPTA^{1,4}

¹DEPARTMENT OF GENETICS AND PLANT BREEDING, INSTITUTE OF AGRICULTURAL SCIENCE, UNIVERSITY OF CALCUTTA, KOLKATA, WEST BENGAL, INDIA

²ALL INDIA COORDINATED RESEARCH PROJECT (AICRP) ON SESAME AND NIGER , KOLKATA CENTRE, WEST **BENGAL, INDIA**

³BENGAL INSTITUTE OF TECHNOLOGY, TECHTOWN, DHAPA MANPUR, HADIA, KOLKATA, WEST BENGAL, WEST **BENGAL, INDIA**

⁴PRESENT ADDRESS: SCHOOL OF AGRICULTURE AND RURAL DEVELOPMENT, RAMAKRISHNA MISSION VIVEKANANDA UNIVERSITY, NARENDRAPUR CAMPUS, KOLKATA

Sesame is one of the oldest oil crops, widely cultivated in Asia and Africa. Genetic control of quantative traits has not yet been documented in sesame. The aim of this study was to assess the population structure and Association mapping of 50 sesame accessions collected from different part of the world. Association mapping, also known as linkage disequilibrium (LD), was applied to germplasm in order to provide new insight into the genetic control of oil content traits. The general linear model (GLM) was applied with the criteria of logP > 3.0 and high stability. Among the 50 sesame accessions, the oil content ranged from 36.25% to 50.63% and a mean of 42.60%. The results revealed

an average genetic diversity, PIC and locus number of 0.61, 0.54 and 3.26 respectively. 12 SSR markers were associated with the oil content trait with high phenotypic variation explanation. The markers are scattered in the different Linkage Groups. Population structure analysis grouped the accessions into five principal groups. A significant impact of population structure on LD in the sesame cultivar groups was observed. These findings may provide valuable foundation for quantative gene identification and marker assisted breeding in sesame. **Keywords**: Association Mapping (AM), Linkage disequilibrium (LD), oil content

IMPACT OF TILLAGE PRACTICES ON PHYSICO-CHEMICAL AND FUNCTIONAL DIVERSITY IN PEARL MILLET-WHEAT CROPPING SYSTEM

DHINU YADAV¹, VIKRAM SINGH², LEELA WATI³, DHARAM BIR YADAV⁴ AND ASHOK KUMAR⁵

¹DEPARTMENT OF MICROBIOLOGY, ²DEPARTMENT OF PLANT PATHOLOGY, ³DEPARTMENT OF MICROBIOLOGY, ⁴DEPARTMENT OF AGRONOMY, ⁵DEPARTMENT OF AGRONOMY, CCS HARYANA AGRICULTURAL UNIVERSITY, HISAR

Conservation agriculture based tillage practices mainly zero-tillage (ZT) considered as major component of sustainable agriculture that involves reducing the tillage operations retaining at coast 30% of plant parts/crop-residues at the soil surface and including crop-rotation in the existing cropping system. More research is needed for better understanding of tillage effects on soil physico-chemical and microbiological properties. Thus, the impact of two tillage systems: no-tillage (NT) and conventional tillage (CT) with different crop-rotations *i.e.* Conventional Tillage Wheat-Conventional Tillage Pearlmillet (CTW-CTPM), Conventional Tillage Wheat-Zero Tillage Pearlmillet (CTW-ZTPM) and Zero Tillage Wheat-Zero Tillage Pearlmillet (ZTW-ZTPM) on physico-chemical and functional diversity of soil was evaluated in the present investigation at CCSHAU, Regional Research Station (RRS) at Bawal during 2014 year. After harvesting of wheat in 2017, triplicate soil samples from undisturbed and disturbed soil were obtained from two different depths (0-15 cm and 15-30 cm), for determination of pH, Electrical Conductivity (EC), CaCO₃, Total N, P and K content, Available N, P, K and S content, Enzymatic activities and Functional diversity of microbes. EC and pH was not significantly affected by tillage systems and values of physico-chemical and functional diversity were recorded relatively higher under ZTW-ZTPM (0.26 %) and the respective values at subsurface layer were 0.25 and 0.23%. In nutshell, NT treatments promoted better physico-chemical and functional diversity of the soil relative to the CT treatment.

Key words: Enzymatic activities, Functional diversity, Nutrient release pattern and Tillage systems

BIOCHEMICAL ANALYSIS OF BUCKWHEAT (*FAGOPYRUM ESCULENTUM* MOENCH) GENOTYPES FOR QUALITY PARAMETERS

K. C. VERMA

LOVELY PROFESSIONAL UNIVERSITY, PHAGWARA(PUNJAB)-144401, INDIA

PRESENT ADDRESS: DEPARTMENT OF BIOCHEMISTRY, GBPUAT, PANTNAGAR, INDIA

Faced with acute problem of protein energy malnutrition in the vast prevailing, vulnerable population of our country, the content and quality of pseudocereal proteins become a pertinent point of consideration. Buckwheat (*Fagopyrum esculentum*), one of the traditional, underexploited crop having food value, can be grown in harsh climatic condition requires low input and is well adapted to environmentally compatible agriculture. In the present study, fourteen genotypes of buckwheat were assessed for their nutritional value. 1000 seed weight was varied from 9.48 gms -15.22 gms. Buckwheat biotypes contains high amount of protein (7.69-15.47 %). Rutin, the most important ingredient of buckwheat was also varies (3.74-6.53%) in different biotypes. It was also found that many essential amino acids are also found in buckwheat. Variations among almost all estimated parameters were found to be highly significant. Thus, buckwheat with higher nutritional value, antioxidant potential and a number of other health benefits is comparable to and even sometimes better than other popular crops and provide benefits beyond nutrition because of the presence of its phyto-active constituents. It can be exploited in nutraceutical and pharmaceutical industries as well.

Keywords: Buckwheat, Protein, Rutin

MITIGATION OF CLIMATE CHANGE IN AGRICULTURE MEHTA PRIYANK AND BHARAT NANDRE

DEPARTMENT OF VEGETABLE SCIENCE, COLLEGE OF HORTICULTURE, S. D. AGRICULTURAL UNIVERSITY, JAGUDAN- 384460

In the age of the so-called "energy-climate era," a new development strategy is required to replace the conventional growth strategy which is faced with many limitations. In preparing for the future, low-carbon green growth has become the main stream as an inevitable core task to be performed home and abroad, and it is anticipated that there will be a lot of discussions in relation to the preparation of a green growth strategy to cope with global warming for a considerable period of time. As the agricultural sector takes up a very low portion of the total amount of domestic greenhouse gas emissions, with approximately 3%, there is a possibility that proper attention may not be paid to the administration of greenhouse gas reduction activities in the agricultural sector. The agricultural sector has a significant potential to contribute not only to the administration of national greenhouse gas reduction but also to the national development of green industries in the future.

THE ECONOMIC STUDIES ON EFFECT OF IRRIGATION SCHEDULING AND NUTRIENT MANAGEMENT ON SWEET CORN (ZEA MAYS L. SACCHARATA) AND ITS RESIDUAL EFFECT ON CHICKPEA (CICER ARIETINUM) IN VERTISOLS OF MARATHWADA REGION.

NILESH MADANRAO MASKE, KALIPADA PRAMANIK AND BHAGWAN V. ASEWAR

DEPARTMENT OF AGRONOMY, MGMNKCA, GANDHELI, AURANGABAD, INDIA

The experiments were carried out in kharif crop seasons of 2016-17 and 2017-18, in a split-plot design, with the main plots consisting of three irrigation schedules (I1: Two irrigations at Knee height and tasseling stage, I2: Three irrigations at Knee height, Tasseling and Early dough stage, I3: Four irrigations at Knee height, Tasseling, Silking and Early dough stage) and sub-plots consisting of three fertility levels

(NPK1: 120:60:60 kg NPK ha-1, NPK2: 150:75:75 kg NPK ha-1, NPK3: 180:90:90 kg NPK ha-1) and two methods of zinc application (Zn1: Soil application ZnSO4.7H2O @ 25kg ha-1 and Zn2: Seed priming @ 1% ZnSO4.7H2O) with three replications. The four irrigations (I3) recorded significantly maximum gross, net monetary returns and B:C ratio of sweet corn crop during both years whereas residual effect of irrigation scheduling did not differed economics of chickpea crop in 2016-17 and 2017-18 however the four irrigations at knee height, tasseling, silking and early dough stage (I3) recorded significantly maximum gross, net monetary returns and B:C ratio of sweet corn-chickpea crop sequence during both years. Application of 180:90:90 kg NPK ha-1 (NPK3) produced significantly highest gross, net monetary return and B:C ratio in sweet corn crop as well as sweet corn-chickpea crop sequence during both years however residual effect of application of 120:60:60 kg NPK ha-1 (NPK3) produced significantly highest gross, net monetary return and B:C ratio in chickpea crop. Seed priming @ 1% ZnSO4.7H2O (Zn2) produced more gross, net monetary return and B:C ratio at harvest compared over soil application ZnSO4.7H2O @ 25kg ha-1 (Zn1) in sweetcorn and sweet corn-chickpea crop sequence however soil application ZnSO4.7H2O (Zn2). Keywords: NPK, Irrigation scheduling, Nutrient management, Crop sequence.

IN VIVO STUDY FOR THE MITIGATION OF *EUGENIA JAMBOLANA* BARK EXTRACTS AGAINST THE ARSENIC INDUCED TOXICITY IN RATS

VINAI PRAKASH, ANKUR ADHIKARI*, HIMANSHUPUNETHA* DEPARTMENT OF BIOCHEMISTRY, G.B. PANT UNIVERSITY OF AGRICULTURE & TECHNOLOGY, PANTNAGAR, U.S. NAGAR 263145, INDIA

Heavy metal toxicity is the most common health hazard because it is naturally occurring element that is ubiquitously present in the environment in both organic and inorganic forms due to which it causes cancer, heart problems and diabetes all over the world due of its chronic exposure. E. jambolana is native to India belongs to family Myrtaceae which commonly known as Jamun or black plum. Various studies showed that the extracts of Jamun have several pharmacological properties such as antidiabetic, antibacterial, anticancer and antioxidative properties. In present study, 70% ethanolic extracts were prepared from the bark of *E. jambolana* and five groups of rats were prepared, Group I- Control, II- Sodium arsenite, III- N-acetyl cysteine + sodium arsenite (10 mg/kg b.wt./day), IV-E.jambolana bark extract + sodium arsenite (200 mg/kg b.wt./day), V-E. jambolana bark extract + sodium arsenite (400 mg/kg b.wt./day).Body weight of rats were measured at 0th, 7th, 14th days as compared to controls at the 200, 400 mg/kg b.wt. Sodium arsenite caused decrease in hemoglobin, packed cell volume (PCV), erythrocyte. PCV value was decreased in the sodium arsenite treated rats but no change was detected in erythrocyte indices. Plasma glucose, blood urea nitrogen, creatinine was increased in sodium arsenite treated rats but decrease in albumin and total protein. In sodium arsenite treated rats serum aspartate aminotransferase (AST) and alanine aminotransferase (ALT) were uplifted. Lipid peroxidation (LPO) was increased and downfall in the activity of antioxidant enzymes- GSH and SOD in RBC, liver, kidney and brain in sodium arsenite injected rats. In dose dependent manner the 70% ethanolic extract of E. jambolana bark altered the negative effect of sodium arsenite and bought back the hematological parameters towards near normal. Sodium arsenite treatment along with extract showed drop in LPO and rise in reduced glutathione (GSH) and SOD activity in erythrocytes and tissues of rats. In plant extract treated rats the glucose, total protein, albumin, BUN, creatinine in plasma and AST & ALT level in serum was brought back to near normal. This study proves that E. jambolana have pharmacological properties against arsenic induced toxicity in rats. Keywords: -Eugenia jambolana, bark extract, sodium arsenite, lipid peroxidation, serum

SOIL HEALTH CARD SCHEME (SHC) IS BENEFIT TO INCREASE FARMER'S INCOME

NIKUNJ JOSHI¹ AND MANISH PATEL

DEPARTMENT OF FRUIT SCIENCE, COLLEGE OF HORTICULTURE, SARDARKRUSHINAGAR DANTIWADA AGRICULTURAL UNIVERSITY, JAGUDAN – 384460, GUJARAT

Soil Health Card Scheme has been introduced in year 2014-15 to assist State Governments to issue soil health cards to all farmers in the country. Soil health card will provide information to farmers on nutrient status of their soil along with recommendation on appropriate dosage of nutrients to be applied for improving soil health and its fertility. Soil status will be assessed regularly every 2 years so that nutrient deficiencies are identified and amendments applied. Soil Health Card scheme has been approved for implementation during the remaining period of 12th Plan to provide 12 crore SHC to the farmers in the country. It is Nation-wide program to conduct farm levee soil analysis. To provide information to farmers on soil nutrient status of their soil and recommendation on appropriate dosage of nutrients to be applied for improving soil health and its fertility. Provide customized crop specific recommendation for nutrient application. Progress: By December 2018, 10.48 crores Soil Health Cards has been distributed.

ECO FRIENDLY AAPROACH IN THE MANAGEMENT OF PESTS OF COTTON

A. K. PANDE

DEPARTMENT OF ENTOMOLOGY, MGM NKCA GANDHELI, AURANGABAD-431007

The field experiment was conducted at Village Sonkhed, Dist:- Nanded (MS) to evaluate the effectiveness of IPM module for the pest management in cotton, cv. NHH-44. Among the IPM and non-IPM practices the IPM module could effectively manage the population of all sucking pests and boll worms on cotton. The effectiveness of IPM module was also reflected on cotton yield which was significantly higher in comparison to non-IPM practices, besides the natural flora and fauna (beneficial insects) were also conserved, the pesticide application reduced and the plant originated infanticides were used for pest management. It was resulted into an eco-friendly approach for the sustainable cotton production.

Key words: Cotton, IPM, Sucking Pest)

IDENTIFICATION OF OTL FOR ROOT TRAITS AND GRAIN YIELD UNDER DROUGHT STRESS AND NON-STRESS CONDITIONS IN RICE (ORYZA SATIVA L.)

CHAVAN NARENDRA RAMESHSING, KALE SONAM SURESHRAO, KADU TANVI PRADEEPRAO, SATISH BALKRISHNA VERULKAR

DEPARTMENT OF PLANT BIOTECHNOLOGY, MGM CABT, GANDHELI, AURANGABAD-431007(MS)

Rice, a staple food for the half of the word population, is challenged by biotic and abiotic stress, declining water resources and increasing global population. Genetic yield potential enhancement of rice under marginal environments is important for increasing production levels to meet the current and future food demands. Roots are essential organs for exploring and exploiting soil resources, such as water and mineral nutrients. Mapping population used in this study was the result of crossing of two indica sub-species adapted to local environment. The F14and F15 generation of the RIL mapping population was phenotyped under combination of rainfed (RF) terminal stage drought (TSD) and irrigated (I) conditions with direct seeding and transplanting during 2014 and 2015 to identify QTL for root traits and grain yield. Genotyping of all 30 selected RIL lines with 8 eight parents were were done using 122 polymorphic SSR and HvSSR markers. The phenotypic and genotypic data was analyzed using QTL cartographer 2.5. Maximum root length, high root pooling strength, less leaf rolling score in line no 18, 21, 23, 24, 26 and 31. Thirteen QTLs were identified for grain yield and fourteen QTLs for root traits under different (irrigated, rainfed and terminal stage drought) conditions during both the years. The recombinant inbred lines exhibited significant interaction with conditions. In general, the lines performing better under stress were poor under non-stress condition; however, two lines (#17 and 57) performed well under all sets of conditions.

Keywords: Drought Tolerance, Quantitative Trait Loci, Grain Yield, Microsatellite Markers, Rice.

COMPARATIVE STUDY OF GROWTH AND YIELD ATTRIBUTES OF DIFFERENT PADDY CULTIVARS UNDER TARAI **REGION OF UTTAR PRADESH**

¹ARUN PRATAP SINGH, ²ASHOK RAI, ¹VIKAS SINGH, ³A K DUBEY, ⁴R N PRASAD AND ⁴JAGDISH SINGH ¹KRISHI VIGYAN KENDRA, SARGATIA, KUSHINAGAR, UTTAR PRADESH ²KRISHI VIGYAN KENDRA, DEORIA, UTTAR PRADESH ³KRISHI VIGYAN KENDRA, LUCKNOW, UTTAR PRADESH

⁴INDIAN INSTITUTE OF VEGETABLE RESEARCH, VARANASI, UTTAR PRADESH

Paddy is a predominant kharif crop of Tarai region of Uttar Pradesh as well as the country and plays a major role in augmenting the income of small and marginal farmers of tarai region of Uttar Pradesh. One of the major constraints of low productivity of paddy is non-adoption of improved package of practices and high yielding variety. To overcome this anomaly a trial was conducted at Krishi Vigyan Kendra, Kushinagar farm during the kharif season 2015-16 with ten high yielding varieties of paddy under three categories, scented fine category viz. HUBR-10-9(V₃), HUBR- 2-1(V₁), HUR- 4-3(V₇), P-1121(V₁₀), P-1612(V₆), fine category viz. BPT-5204(V₈), HUR-36(V₅), HUR-3022(V₂) and coarse category viz. P-44(V₉), Saryu-52(V₄). The experiment was laid out in Randomized Complete Block Design with three replications. The observation were recorded on growth attributing traits viz. plant height (cm), number of tillers per sq.mt., leaf area index and dry matter of plant (gm per sq.mt.) and yield attributing traits viz. number of panicles per plant, panicle length (cm), number of grains per panicle, number of fertile grains per panicle, grain yield (q/ha), straw yield (q/ha) and grain: straw ratio. Good agricultural practices (GAP) were applied to raise healthy paddy crop. The fertilizer dose was applied as 120:60:40 (NPK) and ZnSO4 @ 25kg/ha. Weedicide, Pyrazosulfuran @200gm/ha applied just after transplanting and Bispyribac @200ml/ha as well as Pyrazosulfuran @200gm/ha was applied after 21 days of transplanting. Maximum grain yield was recorded under V₄ (59.5 q/ha) which was statistically at par with V₃ (57.5 q/ha), V7 (55 q/ha), V9 (59.33 q/ha) and significantly superior than rest other varieties, while under scented group V3 recorded highest yield (57.5 q/ha) and under fine rice group V₇ recorded highest yield (55 q/ha) both V₃ and V₇ are at par with V₄. Maximum straw yield was recorded under V₉ (70.5 q/ha) which was statistically at par with V₃ (70.2 q/ha), V₄ (70 q/ha), V₇ (65 q/ha) and significantly superior than rest other varieties. Grain: straw ratio was maximum recorded under V4, V7 and V9 (0.85) which was statistically at par with rest other varieties. Although Saryu-52 is predominant paddy variety in this region and its yield was found maximum but it is closely related to P-44 (under coarse grain category). So it can be replaced by P-44. Under fine category BPT-5204 is predominant paddy variety in this region but its yield is poor and badly affected by draught and diseases, so under fine category it could be replace by HUR-3022 and under scented group HUBR-10-9 could be promoted in this region.

Keywords: Paddy, Growth attributes, yield, Tarai region.

EFFECT OF INTEGRATED APPLICATION OF CHEMICAL FERTILIZERS, ORGANICS AND BIOFERTILIZERS ON YIELD AND BENEFIT COST RATIO OF GUAVA (PSIDIUM GUAJAVA L.) CV. SARDAR

VIKAS CHANDRA*1 H.G. SHARMA2, ADITYA KUMAR3 AND KHIROMANI NAG4

¹DEPARTMENT OF AGRICULTURE, GOVERNMENT OF UTTAR PRADESH, AZAMGARH-276304

² DEPARTMENT OF FRUIT SCIENCE, I.G.K.V., RAIPUR 492012, CHHATTISGARH

³ DEPARTMENT OF ENTOMOLOGY, AKS UNIVERSITY, SATNA, M.P.

⁴ DEPTT. OF FLA, COA, IGKV RAIPUR (C.G.) - 492012

An experiment was conducted during 2015-16 for Mrig bahar crop of guava at Horticulture Research Farm of Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.) to studies the effect of integrated application of chemical fertilizers, organics and biofertilizers on yield and benefit cost ratio of winter season guava. The experiment was laid out in Randomized Block Design with three replications and ten treatments. The results of the experiment revealed that integration of organic manures and bio-fertilizers was more effective in increasing yield and quality of guava fruits than the combination of inorganic fertilizers. Among the various combinations, 75% RDF + Cowdung slurry 10 litre/tree + Azospirillum (100 gm/ tree) + PSB 100 gm/ tree (T₆), was found the best over most of the treatments in respect of yield parameters like weight of fruit (202.15 g), number of fruit per tree (234.88), yield per tree (49.12 kg) and yield per hectare (13.60 tonnes), gross returns (3,83,600Rs. ha⁻¹), net returns (3,24,723Rs. ha⁻¹) and highest B: C ratio (6.52). Keywords: Psidium guajava L., PSB, Azospirllium, yield and benefit cost ratio.

EFFECT OF BROWN MANURING ON GROWTH, YIELD ATTRIBUTES, YIELD AND UPTAKE OF NUTRIENTS BY RICE IN BROADCAST BIASI SYSTEM.

PREETAM KUMAR BAGHEL*, R. M. SAVU AND PARAMJEET SINGH

DEPARTMENT OF AGRONOMY, COLLAGE OF AGRICULTURE, IGKV RAIPUR (C.G.) 492012

Rice is the most consumed cereal grain in the world, constituting the dietary staple food for more than half of the planets human population. Globally, rice is the second most widely consumed cereal next to wheat and it has occupied an area of 163.7 million hectares, with a total production of 749.8 million tonnes (Anonymous, 2015). India the second largest producer after China has in area of over 43.77 millian hectares under rice with production of 116.42 million tonnes of rice (Indiastat, 2019). Nitrogen, phosphorus and potassium are essential inputs and their deficiency is major constraint in the successful cultivation of rice. Farmers apply basal fertilizer at biasi operation which is performed 30-40 days after sowing of rice crop in standing water by cross ploughing using local bullock drawn plough in 5-10 cm flooded water. If rainfall is delayed, biasi operation is performed even after 60 DAS. This leads to poor growth of crop and heavy infestation of weeds. Proper ratio of nutrients required to obtain optimum response in terms of grain yield of rice. Brown manuring is a technique to grow Sesbania in standing rice crop and kill them with the help of herbicide for manuring. After killing the color of the sesbania residue become brown so it called brown manuring. Brown manuring practice introduced where Sesbania crop @ 20 kg ha⁻¹ is broadcasted three days after rice sowing and allowed to grow for 30 days and was dried by spraying 2, 4-D ethyle easter which supplied upto 35 kg ha⁻¹ N, dry matter, control of broad leaf weeds, higher yield by 4-5 q ha⁻¹ due to addition of organic matter in low fertile soils and falling of Sesbania leaves to fall on the ground and forms a layer in the form of mulch which helps in smothering of weeds conserving moisture and adding about 15 kg N ha⁻¹ without adding much on cost of production (Gill and Walia 2014).

Key words: Rice, Brown manuring, Biasi, nutrients and fertilizer

EFFECT OF DIFFERENT THERMAL ENVIRONMENTS ON GROWTH DEVELOPMENT AND YIELD OF DIFFERENT **MUSTARD GENOTYPES**

DEEPAK LAL*, G. K. DAS AND D. K. CHANDRAKAR

DEPARTMENT OF AGROMETEOROLOGY, COLLAGE OF AGRICULTURE, IGKV RAIPUR (C.G.) 492012

Rapeseed-mustard is most valuable edible oilseed crop all around the world after the soybean and palm in term of area and production. Rapeseed and mustard contain 40-45% oil and 20-25% protein in seed. A universal truth is that solar radiation is the unique source of energy especially for plant kingdom. Visible portion of radiation is most important for the crops. It is well known that radiant energy is directly converted into plant biomass. Solar radiation received by the plant during entire growing period is an important component of weather which directly affects the production and productivity of crop. Amount of solar radiation and its distribution over the crop canopy is another weather parameter which regulates the physiochemical and biological processes in plant community. Dry matter production is directly related to radiation use efficiency and conversion efficiency of radiation into photosynthates depends upon the plant varieties and environmental conditions during the entire growing season of the crop. It is essential to determine the crop growth rates at different phenophase, heat use efficiency and radiation use efficiency of mustard cultivars under different thermal environment with manipulation of different sowing dates.

Key words: Mustard, Solar radiation, growth and phenophase

A GENERAL UNDERSTANDING ON HOST PATHOGEN INTERACTION AND PLANT DEFENCE MECHANISM.

DIPANJALI BAG¹; PRASHANT SINGH² AND JASKARAN SINGH³ 1.2CHANDRA SHEKHAR AZAD UNIVERSITY OF AGRICULTURE & TECHNOLOGY, KANPUR- 208002, U.P. ³SARDAR VALLABHBHAI PATEL UNIVERSITY OF AGRICULTURE & TECHNOLOGY, MEERUT

Plant disease presents a constant threat to agriculture around the world. Understanding how plant and pathogen interact with each other is crucial for developing a sustainable agriculture. "Plant pathogen interactions" the name itself creates immense interest in mind of a reader as to what this title beholds. Plant pathogen interactions tells us about how pathogen recognizes its suitable host, plant senses presence of an enemy and what cellular events follow eventually. In nature occurrence of disease is an abnormal phenomenon as in most of the cases plants are resistant (or immune) to most of the microbes present around them. Occurrence of disease requires three (now four) basic elements, a susceptible host, a virulent pathogen and suitable environmental conditions (fourth component proper time of interaction). Only a few microbes fit perfectly into the disease triangle, establish compatibility with host and cause disease in them. In nature, spores of different pathogenic fungi are present but tomato plant never gets infected by rust disease of wheat, this indicates the specificity of plant pathogen interactions. Plants are in permanent contact with a variety of microbial pathogens, such as fungi, oomycetes, bacteria and viruses. To ward off these pathogens, plants must recognize the invaders and activate fast and effective defense mechanisms that arrest the pathogen. Perception of the pathogens is important for activation of a successful plant defense response. Plant cells are capable of sensing evolutionarily conserved microbial molecular signatures, collectively named pathogen-associated molecular patterns (PAMPs) or microbeassociated molecular patterns (MAMPs), by plant pattern recognition receptors (PRRs). MAMPs are molecules that are essential for microbe fitness and survival and are conserved between different species, resulting in an efficient form to sense the presence of pathogens by the plant. The ability of plants to respond to challenge by potential pathogens implies that plants recognise these potential pathogens as 'non-self. Plants defend themselves against pathogens by a combination of weapons termed as host resistance from two arsenals: (1) structural characteristics that act as physical barriers and inhibit the pathogen from gaining entrance and spreading through the plant and (2) biochemical reactions that take place in the cells and tissues of the plant and produce substances that are either toxic to the pathogen or create conditions that inhibit growth of the pathogen in the plant. . These downstream defense responses include the activation of multiple signaling pathways and transcription of specific genes that limit pathogen proliferation and/or disease symptom expression. In addition, antimicrobial compounds are produced, reactive oxygen species (ROS) accumulate, cell wall defense mechanisms are activated and defense hormones, such as salicylic acid (SA), ethylene and jasmonic acid (JA) accumulate. These interactions between plant and pathogen plays a critical role in understanding disease, disease cycle and to know where, when is the best time and at what state of condition to
tackle the disease. More research is required to assess the viability of using induced resistance as it tends to be the new avenue in controlling plant diseases.

EFFECT OF AUXINS ON CALLUS INDUCTION AND ROOT REGENERATION IN BANANA (*MUSA PARADISIACA* L.) CV. UDHAYAM UNDER *IN VITRO* CONDITIONS

SHARDULYA SHUKLA¹, YOGESH RAJBHAR², ANKITA SHARMA³, PUSHKAR DIXIT⁴, ASHISH KUMAR⁵ ^{1,4,5} DEPARTMENT HORTICULTURE, SARDAR VALLABHBHAI PATEL UNIVERSITY OF AGRICULTURE & TECHNOLOGY, MEERUT (2018) -250 110 (U.P.), INDIA.

²DEPARTMENT HORTICULTURE, SARDAR VALLABHBHAI PATEL UNIVERSITY OF AGRICULTURE & TECHNOLOGY, MEERUT-250 110 (U.P.), INDIA.

³DEFENCE INSTITUTE OF HIGH ALTITUDE RESEARCH, DRDO, CHANDIGARH

A study was done to study the effect of different auxins on callus induction and root regeneration in *Musa paradisiaca* L. cv. Udhayam. Minimum time of callus induction (24.41 days) was observed using 2,4-D (4.00 mgl⁻¹); whereas maximum time (39.42 days) was noted under untreated condition (control). With combination of IBA, (2.50 mgl⁻¹) and NAA, (2.00 mgl⁻¹) earliest root proliferation was observed in banana shoots. Minimum days taken for root initiation (11.73 days) were found using IBA,(2.50 mgl⁻¹) and NAA, (2.00 mgl⁻¹). Maximum number of roots (7.03) and maximum rooting percent (87.30%) per plantlet was recorded under the treatment of IBA, (2.5mgl⁻¹) and NAA, (2.00 mgl⁻¹). Viewing above observations has been concluded that 2,4-D (4.00 mgl⁻¹) showed better performance on accordance of callus induction while IBA, (2.50 mgl⁻¹) and NAA, (2.00 mgl⁻¹) gave better performance on accordance of root regeneration. **Keywords**: Banana, micropropagation, explants, sword sucker, callus

NEEM (AZADIRACHTA INDIA) AS FEED ADDITIVE IN POULTRY PRODUCTION

SHRIKANT D. GADEKAR

DEPARTMENT OF ANIMAL HUSBANDRY AND DAIRY SCIENCE, DR. PANJABRAO DESHMUKH KRISHI VIDYAPEETH, AKOLA

The use of herbs and medicinal plants to feed poultry has recently been used as a safe and natural material to stimulate the immune system, treating diseases or using them as catalysts of growth and thus positive impact on the productive performance of poultry. Recent reports have indicated that the use of antibiotics is prohibited many countries due to adverse effects on the health of the consumer as a result of the survival of the residues of these antibiotics in the tissues of the bird's body. The active compounds found in the Neem plant have wide and varied effects on human health as it is considered anti-bacterial, viruses, malaria, infections and antioxidants. The main objective of this study is to review the research currently under way on the Neem plant, which is one of the most important medicinal and herbal plants. Neem (*Azadirachta indica*) is perhaps the most useful traditional medicinal plant in India. Each part of the neem tree has some medicinal property and is thus commercially exploitable. During the last five decades, apart from the chemistry of the neem compounds, considerable progress has been achieved regarding the biological activity and medicinal applications of neem. It is now considered as a valuable source of unique natural products for development of medicines against various diseases and also for the development of industrial products. This review gives a bird's eye view mainly on the biological activities of some of the neem compounds isolated, pharmacological actions of the neem extracts, clinical studies and plausible medicinal applications of neem along with their safety evaluation. **Keywords**: *Azadirachta indica*, hematology, additives, biochemistry, production parameters.

OPTIMIZED HOT AIR PUFFING PARAMETERS AND SHELF LIFE STUDY OF PUFFED SORGHUM AND BAJRA GRAINS

TUKESH B. SURPAM¹ AND I. L. PARDESHI²

DEPARTMENT OF AGRICULTURAL PROCESS ENGINEERING, DR. PANJABRAO DESHMUKH KRISHI VIDYAPEETH, AKOLA

The puffing process can broadly be classified as the sand puffing, salt puffing, air puffing, oil puffing and roller puffing. Puffing is a simplest inexpensive and quickest traditional method of dry heat application, wherein grains are exposed to high temperature for short time (HTST). The optimized parameter for hot air puffing of sorghum and bajra were 0.025 and 0.22 kg/kg dm initial moisture content, 285°C and 355 °C puffing temperature, 5.5 and 4 m/s air velocity and 7982 and 8250 g/h feed rate respectively. As moisture content of whole grain was very low to impart puffing, the moisture content of whole grain was increased to a predetermined level for maximum expansion effect and puffing yield. Since the process for hot air puffing of millet grains involved heat treatments, it is necessary to verify the changes occurring during hot air puffing of sorghum and bajra grains. Therefore, the various bio-chemical composition viz., moisture content, protein, fat, carbohydrates, ash content, tannin and polyphenols content were determined. Moisture content, protein and carbohydrates decreased due to the effect of higher air puffing temperature. It could be observed that there was no significant difference in fat, ash, and polyphenol content in hot air puffed millet grains. Storage studies revealed that at very high humidity (95%) and temperature (45 °C) the hot air puffed sorghum and bajra lost its shelf life within 20 and 18 days in HDPE and 26 and 27 days in Multi layer flexible film respectively. It could be concluded that the hot air puffed grains if stored in Multi layer flexible packaging package at moderate RH (65%) and ambient temperature of 30°C, considerably long shelf life of 174 and 134 days in case of hot air puffed sorghum and bajra respectively. It is seen that 100 micron HDPE could protect about 4, 3 months at 30°C and 65 % RH and the 85 microns of Multi layer flexible could give the shelf life of 6 and 5 months at 30°C and 65 % RH for hot air puffed sorghum and bajra respectively. Key words: Sorghum, Bajra, HTST, Hot air puffing.

PROTEIN ENRICHMENT OF FINGER MILLET PAPAD BY USING WHEY PROTEIN CONCENTRATE

DHANANJAY SATPUTE, GAJENDRA LONDHE, YOGESH PATIL AND SONALI DESHMUKH

DEPARTMENT OF ANIMAL HUSBANDRY AND DAIRY SCIENCE, VNMKV, PARBHANI- 431 402 (MH)

In the present study prepared finger millet *Papad* by supplementing Whey Protein Concentrate (WPC) at different levels of substitution i.e. control (T₀), 2.5 parts (T₁), 5 parts (T₂), 7.5 parts (T₃) and 10 parts (T₄), to assess the nutritional quality, storage stability and overall acceptability of the product. The *papads* were analyzed for physic- microbial and sensory attributes. In related to the physical properties of raw protein enriched finger millet *papad* prepared from treatments T₀, T₁, T₂, T₃ and T₄ content was 19.00, 19.25, 20.25, 20.75 and 21.50 total number, 0.72, 0.70, 0.68, 0.66 and 0.64 mm thickness, 5.75, 5.78, 5.81, 5.84 and 5.87 gm weight, 11.10, 11.06, 11.02, 10.98 and 10.94 cm diameter. In the chemical properties of raw finger millet *papad* 3.29, 3.50, 3.83, 4.10 and 4.49 per cent moisture, 1.64, 1.90, 2.09, 2.26 and 2.49 per cent fat, 7.77, 9.87, 11.05, 13.07 and 14.78 per cent protein, 2.77, 2.95, 3.13, 3.44 and 3.63 per cent ash and 84.53, 81.78, 79.90, 77.13 and 75.11 per cent carbohydrate respectively. Total plate count and yeast and mould count of raw finger millet *papad* was ranged between 0.75 to 5.60 × 10² CFU/g and 0.35 to 3.15×10^2 CFU/g respectively. Physical properties of fried finger millet *papad* were 6.52, 6.60, 6.70, 6.85 and 6.92 gm weight, 13.39 to 17.88 per cent oil absorption, 13.80, 13.92, 13.98, 14.05 and 14.10 cm diameter and Expansion ratio 24.32 to 28.88 per cent. The L* value of fried *papad* was decreased from (T₀) 38.33 to (T₄) 33.15, a* and b* values were increased from 6.05 to 9.89 and 15.00 to 17.48 respectively. The highest overall acceptability score was observed for fried finger millet *papad* was ranged between 1.06 to 1.19 N and 0.45 to 0.64 mm respectively. Key words: - Papad, whey protein, finger millet.

RHIZOSPHERE ENGINEERING- AN INNOVATIVE APPROACH

SANJAM PHUTELA¹, ABHILASH SINGH

¹DEPARTMENT OF SOIL SCIENCE, G.B.P.U. A. & T., PANTNAGAR (U.K.)

²DEPARTMENT OF VEGETABLE SCIENCE, G.B.P.U. A.& T., PANTNAGAR (U.K.)

The rhizosphere is the zone of soil surrounding a plant root where the biology and chemistry of the soil are influenced by the root or an area of intense biological and chemical activity influenced by compounds exuded by the root (mucilage) and by microorganisms. The rhizosphere is strongly influenced by plant metabolism through the release of carbon dioxide (CO_2) and secretion of photosynthate as an array of root exudates (mainly from the rhizoplane and ectorhizosphere). Plant ecosystems are valued for a variety of reasons, e.g., food, feed, and fuel productivity (and hence human livelihood and income), climate regulation, carbon and water cycling, carbon storage, nutrient trapping, provision of wildlife habitats, and recreational activities. The wide range of genotypes that can be collected and/or generated per a specific plant species, genetic diversity is a potentially important asset in maintaining or increasing plant ecosystem values. The main ways plants modify the rhizosphere is through root exudation and there have been few attempts in this context to engineer the rhizosphere by manipulating the efflux of H^+ and organic anions from the roots in transgenic plants (Ryan *et al.*, 2009). Since many genes controlling exudates have been identified, it seems feasible to modify expression levels of those genes in plants to redesign rhizosphere for improved features. For example, Tomato plants transformed with the Arabidopsis vacuolar H⁺-pyrophosphatase gene AVP1, showed approximately 50% greater citrate and malate efflux than wild-types when treated with AlPO4. This was interpreted as a means to enhance resistance to Al^{3+} stress and improve the ability to utilize insoluble phosphorus (Yang et al., 2007). However, it is important to note that plant engineering to impact rhizosphere could be a very complex process due to degradation or inactivation of the engineered compound in the soil, small rate of exudation to influence the rhizosphere, limited knowledge about root exudates composition, and changing of exudate releasing time and levels with plant development and external stimuli. The physical and chemical context of the rhizosphere is the result of many competing and interacting processes that depend on soil type and water content, the composition of microbial communities, and the physiology of the plant itself (Ryan et al., 2009). For better plant productivity, all three components of the rhizosphere, plant, soil and microbes can be engineered. A simple three-strain member consortium, including an engineered Bacillus spp. With two natural or engineered nitrogen fixers like Pseudomonas, Rhizobium and Bradyrhizobium, could provide many of the benefits of a more complex natural rhizosphere community.

Keywords- Rhizosphare, Microorganisms, Ecosystem, Engineering.

PIGMENTED MAIZE: NUTRACEUTICAL POTENTIAL, HEALTH BENEFITS AND PROCESSING ASPECTS DIVYA CHAUHAN AND KRISHAN KUMAR DEPARTMENT OF FOOD TECHNOLOGY, AKAL COLLEGE OF AGRICULTURE, ETERNAL UNIVERSITY, BARU

SAHIB, SIRMOUR-173101, INDIA In recent years, countries such as Bolivia, Germany, China, U.S.A., Mexico and India have increasingly focused on the growth and development of pigmented maize cultivars and hybrids. Pigmented maize cultivars produce kernels of multiple color and are included

development of pigmented maize cultivars and hybrids. Pigmented maize cultivars produce kernels of multiple color and are included among the 346 described races of maize. These pigments include black, yellow, blue, purple, orange, red and other less common shades. The blue-red coloration of pigmented maize is caused by the high concentrations of phenolic compounds called anthocyanins, included in the flavonoids group. These are present in the aleurone layer and pericarp as well as in the endosperm of the grain. Anthocyanins give a pigmented color to maize products and add nutraceutical value (antioxidant activity). Anthocyanins are present as heterosides, and their structures are present as aglycone form (C3-C6-C3 backbone). Major health benefits attached to anthocyanins present in pigmented maize includes anti-cancer, hypolipidemic effect, and lowering the obesity. The most abundant phenolic acid is ferulic acid as reported in the in the kernel of pigmented corn plants, syringic acid in cob and chloro-genic acid in the silk of cob. It has been reported processing treatments such as fermentation causes significant increase in protein, amino acids and total phenolic content but significant reduction in phytic acid content. The corn oil present in the germ portion is useful for production of nutritionally enriched cooking oil or edible oil and cosmetic items. The corn meal is useful for making beneficial snack foods which are rich in nutrients, fortified food products, animal feed rations and fermentation broth additive.

Key words: Pigmented maize, anthocyanins, antioxidant activity, phenolic components

AN ECONOMIC ANALYSIS OF PRODUCTION AND MARKETING OF MAJOR SPICES IN KANKER DISTRICT OF CHHATTISGARH ON CHILLI AND TURMERIC

¹GULSHAN KUMAR GAWDE^{*2} URMILA BHAGAT AND ³MADAN JHA DEPARTMENT OF AGRICULTURAL ECONOMICS IGKV, RAIPUR (C.G.) DEPARTMENT OF VEGETABLE SCIENCE IGKV, RAIPUR (C.G.)

Spices are most profitable venture at all farming activities as it provide ample employment opportunities and slope to raise income of the farming community. In India the climatic conditions are favourable for a large number of spices crops. Consequently the horticulture sector has grown significantly over the years and India has maintained its leadership in many spices. The major constraints pertaining to cultivation of spices were problem of insects, pests and diseases followed by non availability of timely inputs, lack of technical knowledge, lack of soil besting, facility, lack of financing at reasonable interest rate, and shortage of labour. The major constraints of marketing of vegetables were lack of information regarding standardization and grading at grower level followed by lack of post harvest management, lack of storage facilities, lack of regulated and cooperative market, and lack of transportation, lack of awareness about market news and intelligence.

Keywords: Spices, Chili, Turmeric and Market

EFFECT OF APPLIED CALCIUM AND BORON ON THE RELEASE PATTERN OF BORON IN ALFISOL AJIN S ANIL^{*1}, V. K. SHARMA¹, MANDIRA BARMAN¹, S. P. DATTA¹, K. K. BANDYOPADHYAY¹, KAPIL A. CHOBHE¹ AND ATHUL PAWAR¹

DIVISION OF SOIL SCIENCE AND AGRICULTURAL CHEMISTRY, ICAR-INDIAN AGRICULTURAL RESEARCH INSTITUTE, NEW DELHI

Boron (B) is an essential micronutrient and its deficiency is widespread in acid soils of India covering about 30% of the total cultivable area of the country. Liming materials is commonly used for ameliorate the acid soil, which raise the pH of soil, decreases the Al and Mg toxicity and increase calcium (Ca) and magnesium (Mg) concentration in soils. As liming, increases B requirement of plant due to its similarity in function and reduces availability of B in soil due to the formation of Ca-metaborate complex. Also, it leads to significant changes in soil properties *viz*, soil pH, oxides and hydroxides of Fe and Al and concentration of Ca in soil solution, these may influence the adsorption-desorption behaviour of B in soil and subsequently its availability to the crops. Therefore, interactive effect of calcium and boron on the availability of boron in acid soils was studied. For the study, the bulk acid surface soils of Alfisol from Ranchi were collected. Then incubation experiment was conducted under laboratory conditions using this acid soils, where eight treatment combinations of Ca based on lime requirement (0, 1/3, 2/3 and 1.0 LR) and B (0 and 2 mg kg⁻¹) were added and SAE-B was determined at 0, 15, 30 and 60 days after incubation (DAI). In the present investigation, results revealed that application of Ca reduced the SAE-B (salycilic acid extractable-B (SAE-B) increased significantly and consistently with the application of boron (@ 2 mg kg⁻¹ in acid soils collected from Jharkhand. SAE-B content was observed significantly and gradually decreases with the progression of incubation periods. The interaction between Ca and B on SAE-B was significant in Alfisol (Ranchi).

PERMACULTURE: ITS FUTURE AND PROSPECTS IN INDIAN CONTEXT

ADESH SINGH* AND SANJEEV SINGH

DEPARTMENT OF AGRONOMY, COLLEGE OF AGRICULTURE, SARDAR VALLABHBHAI PATEL UNIVERSITY OF AGRICULTURE AND TECHNOLOGY, MEERUT, (U.P).-250110

Natural farming is an ecological farming approach established by Masanobu Fukuoka (1913-2008), a Japanese Farmer and philosopher, introduced in his book "The One Straw Revolution" in (1975). Fukuoka described his way of farming as Japanese. It is also referred to as "the Fukuoka Method", "the natural way of farming" or "do-nothing farming". The title refers not to lack of effort, but to the avoidance of manufactured inputs and equipment. Permaculture is related to fertility farming and sustainable agriculture agroecology, agroforestry, ecoagriculture and natural farming, but should be distinguished from biodynamic agriculture. The system works along with the natural biodiversity of each farmed area, encouraging the complexity of living organisms, both plant and animals that shape each particular ecosystem to thrive along with food plants. Fukuoka saw farming both as a means of producing food and as an aesthetic or spiritual approach to life, the ultimate goal of which was, "the cultivation and perfection of human beings". He suggested that farmers could benefit from closely observing local conditions. Natural farming is a closed system, one that demands no human-supplied inputs and mimics nature. Healthy soil is the foundation upon which natural agriculture is built. Farming practices differ mainly based on soil inputs and crop protection measures. In conventional chemical farming practice, indiscriminate use of chemical fertilizers and pesticides destroy the beneficial soil micro flora change the soil nature and also contribute to the high crop production cost. Heavy metals from the polluted soil may enter the food chain in significant amounts and show adverse health effects. The essence of natural farming is to minimize the external inputs to the farm land, and nurture the soil fertility. It was shown that enrichment of soil occurs through propagation of beneficial soil microbes. Studies showed that permaculture/natural farming, with the minimum external inputs and by application of supplements like Jeevamruth, improves the soil fertility by increasing the soil micro flora and available nutrients in it.

BIOFORTIFICATION OF RICE WITH ZINC: A KEY TO ALLEVIATE THE MALNUTRITION IN HUMANS SANJEEV SINGH* AND ADESH SINGH

DEPARTMENT OF AGRONOMY, COLLEGE OF AGRICULTURE, SARDAR VALLABHBHAI PATEL UNIVERSITY OF AGRICULTURE AND TECHNOLOGY, MEERUT,(U.P).-250110

Application of Zn fertilizers or Zn-enriched fertilizers (ferti-fortification) offers a rapid solution for increasing Zn concentration in grain and straw. Application of Zn fertilizer (ferti-fortification) to basmati rice through ZEU, Zn-EDTA and foliar spray of 0.2% (ZnSO4.H₂O) increased Zn concentration in grain and straw, resulting in greater bio-availability of grain Zn. ZnSO4 application in splits(soil + foliage) soil application + foliar spray at different stages recorded the highest grain yield with high Zn content in grain and brown rice. **Key words:** biofortification, rice, zinc, micronutrients

LIVELIHOOD SECURITY OF SMALL AND MARGINAL FARMERS IN AMBALA DIVISION OF HARYANA STATE SAURABH ARYA¹, ASHA BATRA¹ AND ARPIT ARYA^{*2}

¹DEPARTMENT OF EXTENSION EDUCATION AND COMMUNICATION MANAGEMENT, CHAUDHARY CHARAN SINGH, HARYANA AGRICULTURAL UNIVERSITY HISAR-125004

²DEPARTMENT OF FOODS AND NUTRITION, GOVERNMENT HOME SCIENCE COLLEGE, CHANDIGARH

The present investigation "Livelihood securities of small and marginal farm families of Ambala division of Haryana state" was conducted in Ambala division of Haryana state. Two district from Ambala division i.e. Ambala and Yamunanagar were selected randomly. One block from each district viz. Sadhora block from Ambala and Nareingarh block from Yamunanagar district were selected randomly. From selected two blocks Sadhora and Nareingarh four villages (two from each block) Rajpur and Nashera from Sadhora, Sain Majra and Badi Ujjal from Nareingarh were selected randomly. Thus a total of 300 respondents were selected randomly. Statistical tools frequency percentages, weighted mean score and ranking were applied for data analysis. In the present study livelihood security was assessed by developing media on identified aspect of livelihood security. Food security was concerned majority of the respondents had sources of food from their own farm production cum market, had two meals lunch and dinner/ day, less than forty per cent of the respondents rarely consumed fruit. Most of the respondents had enough food to eat but not quality. Most of the respondents in both the districts had enough consumption of cereals, milk and milk products. Consumptions of pulses, vegetables and fruits were very less. Regarding economic security less than half of the farm families had household annual income between 1 to 2 lacks annually. More than seventy five per cent of the respondents possessed land upto Rs. 10 lakh as a productive assets. Eighty five per cent of the respondents had gold upto 50 gram as unproductive assets. Possession of value of residential property between2-4 lakh by more than sixty per cent of household. Fifty per cent of respondents were somewhat dissatisfied with their current financial conditions.

Key words: livelihood, security, food security, small and marginal farmers, rural .

ASSOCIATION OF PHYSICAL ACTIVITY WITH OVERWEIGHT AND OBESITY IN ADOLESCENT (10-14 YEARS) IN SCHOOLS OF CHANDIGARH, INDIA

ARPIT ARYA¹ AND SAURABH ARYA*²

¹DEPARTMENT OF FOODS AND NUTRITION, GOVERNMENT HOME SCIENCE COLLEGE, CHANDIGARH 160010 ²DEPARTMENT OF EXTENSION EDUCATION AND COMMUNICATION MANAGEMENT, CCS, HARYANA AGRICULTURAL UNIVERSITY HISAR-125004

The study was conducted with the objective to find the association of physical activity with that of overweight and obesity in school students of age group 10-14 years. The random sampling method was used for selecting the students of both the sexes from their respective classes (5th to 9th class) in both Government schools and Private schools of Chandigarh. It was observed that regular physical activity could assist in controlling overweight and obesity. The prevalence of overweight and obesity when compared with physical activity as a function of gender is minor because the overall prevalence remains almost same among adolescents. Consequently, the role of physical activity, games and sports should be stressed and amenities for outdoor games in schools relatingto high physical activity should be elevated with obligatory hours of sports/ games.

Keywords: Adolescent, overweight, physical activity

EFFECT OF DATES OF TRANSPLANTING ON GRAIN YIELD & YIELD COMPONENTS OF RICE CULTIVARS IN THE *TERAI* AGRO-CLIMATIC ZONE OF WEST BENGAL S.B.SATPUTE AND S. BANDYOPADHYAY

DEPARTMENT OF AGRONOMY, UTTAR BANGA KRISHI VISWAVIDYALAYA, COOCHBEHAR, WEST BENGAL

A Field experiment was conducted at the Instructional Farm of Uttar Banga Krishi Viswavidyalaya, Pundibari, Cooch Behar, West Bengal for two consecutive years during *kharif* season of 2012 and 2013 to find out the rainy season rice variety of suitable duration adjusting with affordable planting time in the *terai* agro-climatic zone of West Bengal. The Experiment was laid out in split plot design with 3 replications comprising five main plots: dates of transplanting $(D_1=01^{st} July; D_2=10^{th} July; D_3=20^{th} July; D_4=30^{th} July; D5=09^{th}$ August) and six sub plots: cultivars (V1 IET-6223; V2: IET-14461; V3: MTU-1010; V4: IET-17430; V5: MTU-7029; V6: MTU-1075). . Number of days to panicle initiation was decreased with delay in transplanting in all the cultivars. For rest of the phenophases, no definite trend was observed. However, the duration from sowing through maturity was increased towards D1 to D5 in all cultivars. The test weight was significantly different according to the cultivars tested. There was significant difference in grain yield and straw yield due to the effect of date of transplanting and cultivars. Crop transplanted on 10th July recorded maximum grain yield (4.64 t ha⁻¹) and straw yield (6.56 t ha⁻¹) followed by the transplanted on 20th July reduced more than 20% grain yield irrespective of varieties. Among short duration cultivars IET-14461 recorded maximum grain yield (4.21 t ha⁻¹), among medium duration MTU-1010 (4.56 t ha⁻¹) and among long duration MTU-7029 recorded maximum grain yield (4.65 t ha⁻¹).

Keywords: Rice, Grain Yield, Straw Yield.

MICRO-IRRIGATION: PRECISION WATER MANAGEMENT USING SUB-SURFACE IRRIGATION IN CEREAL BASED CROPPING SYSTEM

JYOTIRMAYA SAHOO^{1*}, MD BASIT RAZA¹, AJIN S ANIL¹, PAWAR ATUL BHAGAWAN¹ ¹DIVISION OF SOIL SCIENCE AND AGRICULTURAL CHEMISTRY, ICAR-INDIAN AGRICULTURAL RESEARCH INSTITUTE, NEW DELHI-110012.

Agriculture is the major water-consuming sector in India. Management of water in water-scarce and water-stressed regions is the need of the hour order to reduce the aggregate demand for water to match the available future supplies (Kumar, 2008). The micro-irrigation (MI) technologies, such as drip and sprinkler are the key interventions in water saving and improving crop productivity. It is evident that a properly designed and managed MI system could save 40-80% of water and facilitate a 100% water use efficiency (WUE) as compared to 30-40% under conventional practice (Narayanamoorthy, 2004). Initially, subsurface drip irrigation (SDI) was used primarily for high value crops, such as fruits, vegetables, nuts and sugarcane. With the increase in reliability and longevity of the system, it has now been adapted in

lower-valued agronomic crops (Camp *et al.*, 2000). Laser land levelling and drip irrigation techniques used for paddy cultivation was observed to save huge quantity of irrigation water in paddy cultivation (Yaligar *et al.* 2017). The rice-wheat cropping system (RWCS), which occupies about 18 million ha in south Asia and China, is of immense importance for food security (Dawe *et al.*, 2004). Conventional management factors such as flood irrigation, intensive tillage operation and residue burning are a threat to RWCS. Thus, drip irrigation is now being considered as an economically viable option for field crops. However, adoption of these water saving options is sluggish for field crops in general and RWCS in particular due to their field applications (surface drip) issues with conventional tillage-based management systems.

PRECISION IRRIGATION: THE NEXT AVENUE OF HIGHLY IRRIGATED PUNJAB

ANIKETA HORO¹, JAGRUTI DAS², ASHUTOSH KUMAR³

¹DEPARTMENT OF ECONOMICS AND SOCIOLOGY, PUNJAB AGRICULTURAL UNIVERSITY, LUDHIANA, ²DIVISION OF ECONOMICS, STATISTICS AND MANAGEMENT, ICAR-NDRI, KARNAL ³DEPARTMENT OF HOPTICULTURE, INSTITUTE OF ACRICULTURAL SCIENCES, RHU VARANASI

³DEPARTMENT OF HORTICULTURE, INSTITUTE OF AGRICULTURAL SCIENCES, BHU, VARANASI

Precision in irrigation means to cater to the water requirements of every individual plant and not that of the soil, thereby yielding higher production and productivity with reduced costs and increased water use efficiency. The net irrigated area of Punjab has increased during 1970's to the present day i.e. from 71% to 99% against the national average of 34.5%, thereby, making it the highly irrigated state of the country. Laser land leveller, tensiometer, Happy Seeder and zero- till –drill are some of the resource conservation technologies (RCT's) that have been widely adopted by the farmers. Some of these technologies have been developed by the Punjab Agricultural University over the time and the University has been imparting the technical know-how and economics of usage of these RCTs. This paper tries to economically review the land degradation problems and the prevalent precision irrigation technologies in the state to save the resources and the cost as well. Over the years, the share of irrigation cost in the total cost of production for wheat has declined from 4.35% in 1970-71 to 2.02% in 1991-2001 and 0.96% during 2015-16 while the production of wheat has increased from 5.1 thousand MT in 1970-71 to 15.09 thousand MT in 2000-01 and 16.08 million MT during 2015-16. This indicates that the irrigation cost has a negative, while the irrigation has a positive relationship with wheat production.

Keywords: Precision irrigation, Punjab, Resource Conservation Technologies (RCTs), Mechanization

MODELLING RAINFALL-RUNOFF USING ARTIFICIAL NEURAL NETWORK AND MULTILINEAR REGRESSION TECHNIQUES FOR HARIPURA DAM UTTARAKHAND.

BASANT BALLABH DUMKA¹, PRAVENDRA KUMAR²

¹DEPARTMENT OF SOIL AND WATER CONSERVATION ENGINEERING, COLLEGE OF TECHNOLOGY PANTNAGAR, UTTARAKHAND

²DEPARTMENT OF SOIL AND WATER CONSERVATION ENGINEERING, COLLEGE OF TECHNOLOGY PANTNAGAR, UTTARAKHAND

The main objective of this study was to develop model between rainfall and runoff using Artificial Neural Network (ANNs) and multilinear regression techniques. This study deals with the location and climate of study area, collection of rainfall and corresponding runoff data and methodology adopted for rainfall-runoff correlation and modelling it using artificial neural networks and multilinear regression techniques for Haripura dam at U.S. Nagar (Uttarakhand) and criteria for evaluating performance on the basis of mean square error of the models is also discussed. The rainfall-runoff data in 20 years (1991-2010) is considered for developing models. The maximum value of correlation coefficient between rainfall and runoff for testing data is 0.84672, for overall data it is 0.88135 at number of neuron 29 for Artificial Neural Network using Levenberg Marquardt training function. For multilinear regression model the value of coefficient of correlation is equal to 0.83211. Thus we conclude that Artificial Neural Network give slightly better results rather than multilinear regression models.

Key words: Artificial Neural Network (ANN), Multilinear Regression Techniques (MLR), Levenberg Marquardt (LM) training function.

FORMULATION OF NANOPARTICLES THROUGH AGROWASTE

RAJVEER SINGH¹, MANOJ KUMAR CHITARA², RAJEEW SHUKLA¹ ¹DEPARTMENT OF AGRONOMY, COA, GBPUA&T, PANTNAGAR ²DEPARTMENT OF PLANT PATHOLOGY, COA, GBPUA&T, PANTNAGAR

Agriculture contributes a large share to the GDP of our country nearly 17.3 percent. However, it generated million tonnes of agro-waste every year in India and globally. This includes crop waste, food processing waste, animal waste and also hazardous and toxic waste like pesticides insecticides, herbicides etc. Although there are technologies utilizing this waste to generate energy, the organic waste coming from agriculture remains a challenge, researchers and investigators need to focus on more and more ways to reduce this waste and derive direct and indirect benefits from it for a sustainable growth. Anyhow one of the solutions to this giant pile of problem may be answered by nanotechnology. In recent years nanotechnology has reached nearly every sector of science ranging from medical, industrial, agricultural, and even house old utilities. And have massively facilitated in evolution of existing technologies. Nanotechnology refers to a field of science where materials ranging from the size of 1 to 100 nm are dealt with. Nature comprises of many biotic species like plants, algae, fungi, yeast, etc. which are composed of biomolecules. They take part in the formation of nanoparticles with distinct shapes and sizes thereby acting as a driving force for the biosynthesis of nanoparticles with an environmentally benign process. The use of waste materials not only reduces the cost of synthesis but also minimizes energy requirement in comparison to physical or chemical synthesis methods, the need of using harmful chemicals or byproducts, and stimulates 'green synthesis'. Implement of Agro-waste would be unquestionably a strong step towards sustainable development. The nanotechnology seeks its application in all most all area of science and technology, agriculture is no exception to that, yet a lot of development in the field has to happen for establishment of nanotechnology in agro industrial sector as agriculture is known as the back bone of our economy.

Keyword: Agro waste, nanotechnology, green synthesis, nanoparticle.

HYDROGEL: FUTURE'S BOON FOR HORTICULTURAL CROP'S

TURI DHARA AND D. R. KANZARIA

DEPARTMENT OF FRUIT SCIENCE, COLLEGE OF HORTICULTURE, JUNAGADH AGRICULTURAL UNIVERSITY, JUNAGADH- 362001

Hydrogels are water swollenplymer chain, having capacity to imbibe water when placed in aqueous environment. This ability to swell, under biological conditions, makes it an ideal material for use in drug delivery and immobilization of proteins, peptides, and other biological compounds. Due to the inimitable physical and chemical distinctiveness of hydrogels, such as hydrophilicity, Swell ability and modifiability, there is increasing explore interest in the development and application of novel hydrogels in horticultural crops. Hydrogels have exhibited superior performance in the adsorptive removal of a wide range of aqueous pollutants including heavy metals, nutrients, and toxic dyes. Major challenge pertaining to adsorption kinetics, operational pH range, interference, and hydrogel recovery are examined. Hydrogel is beneficial for practically all forms of agriculture, horticulture and gardening, from fields, orchards and vineyards, to lawns, grass sports fields, parks, gardens, flower beds, and plant pots and boxes Because the major requirement of the horticulture is water and if we use the hydrogel it increase water use efficiency as well. These hydrogels have the ability to sense changes of pH, temperature, or the concentration of metabolite and release their load as result of such a change. Day by water is decline phase due to which quality water is less present on the earth So the solution for this save water as well use of these kind of material for sustainable agriculture **Keywords**: Hydrogels; Horticultural Crops, pollutants

APPLIED CROTONYLIDENE DIUREA ON CHANGE IN SOIL ENZYME ACTIVITY AND NUTRIENT AVAILABILITY USING VERTISOL

PAWAR ATUL BHAGAWAN¹*, M.R. CHAUHAN¹, PANDURANG DIVTE², AJIN S ANIL², MD. BASIT RAZA² ¹DIVISION OF SOIL SCIENCE AND AGRICULTURAL CHEMISTRY, MAHATMA PHULE KRISHI VIDYAPEETH, RAHURI

²DIVISION OF SOIL SCIENCE AND AGRICULTURAL CHEMISTRY, ICAR-IARI, NEW DELHI

Soil microbial activity is recognized as an important factor affecting nitrogen (N) release from slow-release fertilizers. However, studies on the effect of slow release nitrogen fertilizers like Crotonylidene diurea, on soil enzyme activity and nutrient availability provided under this study was conducted at ambient conditions during 2015-16. Hence, the aim of this study was to better understand such relationships by determining the release of N from slow-release fertilizer Crotonylidene diurea and urea in soils with different enzyme activities and bacteria population. The results indicated that the addition of nitrogen through ordinary urea and crotonylidene diurea as per recommended dose of nutrients in an incubation study found beneficial for soil enzyme activity, microbial population, periodical ammonical and nitrate nitrogen content and available phosphorus and potash. The study was significantly higher in treatment GRDN and numerically followed by 100% N through CDU because of increased microbial population resulting organically bound phosphorus and potassium have been mineralized and become available.

INFLUENCE OF METROLOGICAL PARAMETER ON DISEASE DEVELOPMENT OF SCLEROTINIA STEM ROT OF MUSTARD UNDER ARTIFICIAL INOCULATION CONDITION

PRAMOD KUMAR FATEHPURIA^{1*}, R. K. PANDYA², RAJNI SINGH SASODE², HEMANT TRIVEDI² AND J.C.GUPTA³

¹DEPARTMENT OF PLANT PATHOLOGY, SCHOOL OF AGRICULTURE, ITM UNIVERSITY, GWALIOR, MADHYA PRADESH, INDIA

²DEPARTMENT OF PLANT PATHOLOGY, COLLEGE OF AGRICULTURE, RAJMATA VIJAYARAJE SCINDIA KRISHI VISHWA VIDYALAYA, GWALIOR, MADHYA PRADESH, INDIA

³ZONAL AGRICULTURE RESEARCH STATION, MORENA, RAJMATA VIJAYARAJE SCINDIA KRISHI VISHWA VIDYALAYA, GWALIOR, MADHYA PRADESH, INDIA

Rapeseed mustard is the major Rabi oilseed crops of India. Stem rot of mustard is most dreaded disease caused by *Sclerotinia sclerotiorum* (Lib.) de Bary. An experiment was laid out on epidemiological studies of stem rot of mustard predicting of infection and progressive development of the disease during 2016-17 and 2017-18 at experimental field of department of Plant Pathology, RVSKVV, Gwalior (Madhya Pradesh). The maximum relative humidity and minimum relative humidity influenced the lesion length, number of sclerotia and size of sclerotia and weight of sclerotia positively and significantly whereas evaporation influenced it negatively and significantly. The standard partial regression coefficient (β –value) indicated that the minimum humidity had relatively more important on stem lesion length, number of sclerotia, size of sclerotia and weight of sclerotia followed by Maximum humidity, maximum temperature and Evaporation. The minimum relative humidity is 29.16% required for the initiation of the lesion length and thereafter 1% increase may result an increase in size of sclerotia by 2.88%. Meanwhile, 25.18% minimum relative humidity is required for the initiation of the number of sclerotia by 2.81% of sclerotia and thereafter 1% increase in weight of sclerotia and thereafter 1% increase in sclerotia by 2.88%. Meanwhile, 25.18% minimum relative humidity is required for the initiation of the number of sclerotia by 2.88%. Meanwhile, 25.18% minimum relative humidity is required for the initiation of the number of sclerotia by 7.17%. However, 21.11% minimum relative humidity is required for the initiation of the weight of sclerotia and thereafter 1% increase in weight of sclerotia by 0.046%.

Key words: Sclerotinia sclerotiorum, lesion, humidity and sclerotia

EFFECT OF NITROGEN LEVELS AND BORON ON GROWTH, YIELD AND QUALITY OF RADISH (RAPHANUS SATIVUS L.) CV. PUSA RESHMI

RAMPAL, KR MAURYA, ABHISHEK SINGH, ASHUTOSH GUPTA AND BINEETA DEVI DEPARTMENT OF HORTIVULTURE AKS UNIVERSITY SATNA, MADHYAPRADESH

A field experiment, entitled "Effect of nitrogen levels and boron on growth, yield and quality of Radish (Raphanus sativus L.)" was carried out at Horticulture research farm of AKS University, Sherganj Satna (M.P.) during Rabi season of 2018-19. The experiment was laid out in Randomized Block Design with twelve treatments and three replication. The treatment comprises of application of T1-nitrogen @ 0 kg/ha + Boron @ 0 kg/ha, T3- nitrogen @ 0 kg/ha + Boron @ 20 kg/ha, T4- nitrogen @ 40 kg/ha +

Boron @ 0 kg/ha, T5- nitrogen @ 40 kg/ha + Boron @ 10 kg/ha, T6- Potassium @ 40 kg/ha + Boron @ 20 kg/ha, T7- nitrogen @ 80 kg/ha + Boron @ 0 kg/ha, T8 - nitrogen @ 80 kg/ha + Boron @ 10 kg/ha, T9 – nitrogen @ 80 kg/ha + Boron @ 20 kg/ha, T10- nitrogen @ 120 kg/ha + Boron @ 0 kg/ha, T11- nitrogen @ 120 kg/ha + Boron @ 10 kg/ha, T12- nitrogen @ 120 kg/ha + Boron @ 20 kg/ha the variety 'Pusa reshmi' was used for the study. The observations on growth yield and quality parameters were recorded, the results of present study indicated that the, there were significant differences in growth, yield and quality of radish due to different treatments. The maximum plant height (38.71cm), plant spread (72.18) number of leaves (17.17), fresh weight of leaf (182.78 g), dry weight of leaves (32.85 g), leaf area (1212.94) leaf area index (4.15) root length (29.25 cm), root diameter (5.04 cm), root to shoot ratio (2.39) average yield gm. per plant (175.35), root yield kg per plot (40.22 Kg), root yield quintal per hectare TSS (10.25%), ascorbic acid (28.15%), and B:C ratio (1.95) were observed in the treatment T11 (nitrogen@ 120 kg/ha + Boron @ 10 kg/ha). Hence, considering the positive effects of the different levels of nitrogen and boron it can be concluded that, the application of nitrogen @ 120 kg/ha and boron @ 10 kg/ha was found to be beneficial for radish crop grown under Satna (M.P.) condition.

Keywords: Nitrogen, boron, growth, yield, and quality, radish

EXPLORE OF LIGNO-CELLULOLYTIC MICROBIAL CONSORTIA ON PADDY STRAW DECOMPOSITION IN VERTISOL

SWARNIMA SHRIVASTAVA^{1*}, S. K. VERMA¹, A.K. PATRA², M.C. MANNA² AND VINAY ARYA¹ ¹DEPARTMENT OF SOIL SCIENCE AND AGRICULTURAL CHEMISTRY, RVSKVV, GWALIOR-474002 ²INDIAN INSTITUTE OF SOIL SCIENCE, BHOPAL-462038

The present investigation is an account of soil quality parameters as influenced by paddy straw decomposition and its subsequent inoculation with microbial consortia. Such information may prove useful for fast decomposition of paddy straw and improve soil carbon content and it may provide an option to combat crop residue burning because time difference between rice harvest and wheat sowing is only 15-30 days, not sufficient for decomposition and eventually clean field. Moreover residue removal from field for off-situ composting is a labour intensive process. So there is a need to find out an alternative way to address this issue. The study revealed that amongst treatments there was no significant difference observed in terms of pH and EC of the soil. However, the decomposition of paddy straw along with *Aspergillus spp.* + *Bacillus spp.* + *Streptomyces spp.* (T₈) resulted in significant increase in organic carbon contents of the soil from 0.63 % to 0.68%. It is apparent from result that integration of straw with consortia resulted significantly the maximum content of available and potassium content in soil as compared to the treatment which receive single consortium of fungal, bacterial or actinomycetes. The phosphorus content of soil was not increased significantly with the use of paddy straw + *Aspergillus spp.* + *Bacillus spp.* + *Streptomyces spp.* consortia. The Easily Extractable and Total Glomalin Related Soil Protein after 60 days of residue decomposition, in moist soils were not affected by straw decomposition with microbial consortia. Addition of straw along with *Aspergillus spp.* + *Bacillus spp.* + *Baci*

Keywords: Ligno-cellulose, paddy straw, Aspergillus spp., glomalin protein, soil respiration.

INTEGRATED EFFECT OF VARIETIES AND FERTILITY LEVELS ON PROTIEN CONTENT IN FORAGE SORGHUM VINAY ARYA, SHASHI S. YADAV, SWARNIMA SHRIVASTAVA, AND HEMLATA DHAKAD DEPARTMENT OF SOIL SCIENCE AND AGRICULTURAL CHEMISTRY

RAJAMATA VIJAYARAJE SCINDIA KRISHI VISHWAVIDHALAYA, GWALIOR(M.P.) - 474002

Sorghum is one of the most important fodder crops in rainfed conditions of India, being a short duration, drought and salt tolerant, well adaptive to arid regions is considered promising crop to overcome the green fodder for animals. In India, its grain has been traditionally used for livestock feed as; stems and foliage for green chop, hay, silage and pasture. Their ability to tillering and re-grow after cutting makes them ideal for multi-cut hay crops and grazing situations. Multicut has a potential for intensive fodder production under irrigated condition. When harvested at flowering stage, the forage contains about 6-7% crude protein, 30- 31% crude fibre and 9-10% mineral matter. Protien content is one of the most important parameters affecting the nutritional value of fodder crops. Present investigation was carried out to study "Integrated Effect of Varieties and Fertility levels on Protien content in Forage Sorghum " under adoptive climatic conditions of Northern part of Madhya Pradesh was carried out during Kharif season 2014 at the Research Farm, College of Agriculture, R.V.S.K.V.V., Gwalior (M.P.). The experiment was laid out in randomzied block design (F.R.B.D.) replicated three times with 2 variety (ICSSH-28 & IS-17349) and 6 fertility level namely F1 (10 t of FYM), F2 (50% of RDF), F3 (50% of RDF + 5 t FYM + Azotobacter + PSB), F₄ (75% RDF), F₅ (75% of RDF + 2.5 t FYM + Azotobacter + PSB), F₆ (100% RDF). Sorghum varieties were grown by considering recommended package of practices. It is evident from the data that there was significant difference in protein content in the varieties under study. Variety ICSSH-28 (V₁) recorded significantly higher protein content over to variety IS-17349 (V₂). In both cuttings application of 10 t of FYM (F₁) showed significantly higher protein content in sorghum fodder, which was significantly superior over remaining fertility level treatments. The interaction effects with respect to varieties and fertility levels on protein content in fodder in both the cuttings were significant. Maximum protein content in fodder was recorded with V₁F₁ (ICSSH-28: 10 t of FYM) followed by V₂F₁ (IS-17349: 10 t of FYM) which were statistically at par and significantly higher over rest of treatment combinations, similar effect was observed in both the cuttings.

Key words: Forage, Sorghum, Variety, Protein

BEES REALLY MATTER: CONSERVATION APPROACHES FOR BEES IN INDIA PRIYANKA BHATT

VCSG UTTARAKHAND UNIVERSITY OF HORTICULTURE AND FORESTRY, BHARSAR, PAURI GARHWAL, UTTARAKHAND, INDIA

If the bees disappeared off the face of the earth, man would only have four years left to live. Albert Einstein was aware of the importance of bees in nature and he quoted this in connection to the colony collapse disorder that caused mortality in many honey bee colonies in U.S.A. Honey bees are primary pollinators in the world pollinating various crops in tropical and temperate ecosystems. They are the nature's best gift to mankind as they pollinate trees, crops for better fruit set and productivity in terms of yield helping human population to sustain on the earth. Honey bees increase food security by giving valuable products such as honey, bee wax, propolis, royal jelly and bee

venom which have huge prices in international market, making it a profitable business for marginal farmers, women and unemployed youth. Honey bees, Apis mellifera and Apis cerana, are widely managed in hives for crop pollination. Reduction in the number of domesticated bees all over the world especially in U.S.A have raised concerns and now need is felt for their conservation. Conservation of honey bees whether domesticated or wild species is very necessary due to loss of their natural habitat, loss of colonies due to pests and diseases (colony collapse disorder and mite diseases) and pesticides use ,especially neonicotinoids. Neonicotinoids disrupt the foraging abilities of bees and many bees even forget their way to the hives. The need for establishing pollinator monitoring programs was recognized internationally in 1993 when pollinators were incorporated into the Convention on Biological Diversity, which has been signed by 168 countries. In Belgium, 25% of bee species have declined during the second half of the 20th century. In European countries, 37-65% of bee species are on lists of conservation concern In order to spread awareness for conservation of bees across the world, world honey bee day is celebrated each year and in 2019 it was celebrated on 25th May. India is not aware of the dangers of species or habitat loss of bees as not much research has been documented in relation to their diversity in agroecosystem and natural habitats but decreasing land use, urbanization, killing of wild bees, pesticide use and lack of awarenes, infrastructure and technical knowledge are the major constraints and threats to bees in India. To conserve bees a strong regulatory framework should be made by policy makers for preventing killing of bees, honey bee protection act should be implemented and enforced. The government should take initiatives to open a national research centre on honey bees or other centres in various states to promote the build up of population of honey bees and other bee pollinators. Nucleus culture of good quality queens should be maintained to sustain colonies of bees. Deforestation should be discouraged and natural bee flora should be restored if destroyed by jungle fires. In urban areas bee flowering plants can be planted across roads, pathways and on roof tops of houses to attract bees. Intensive studies should be done on the effect of pesticides on bees and the pesticides which are harmful to bees should be banned. Bees should be treated as a living entity and not as a business for honey production then only bees can be protected and conserved in near future in India.

Key words: Honey bees, conservation, A.mellifera, A.dorsata, A.mellifera, honey

INNOVATIVE TECHNOLOGIES ADOPTED FOR THE PRODUCTION OF HORTICULTURAL CROPS PANKAJ YADAV

DEPARTMENT OF HORTICULTURE, MAHARANA PRATAP HORTICULTURAL UNIVERSITY, KARNAL

The horticulture sector is considered as the most dynamic and sustainable segment of agriculture. Horticulture is one of the best options for improving the productivity of land, ensuring nutritional security for mankind and for sustaining the livelihood of the farming community worldwide. In order to optimize the use of resources, hi-tech interventions like precision farming, which comprises temporal and spatial management of resources in horticulture, is essentially required. Infusion of technology for an efficient utilization of resources is intended for deriving higher crop productivity per unit of inputs. For improvement in crop production and returns to farmers, sensors, robotics, precise irrigation, are introduced in horticulture. A 3D volumetric intersection technique is used to sort tomato seedlings at a speed of 40.000 pieces per hour and measures the full 3D geometric features, which is clearly an impossible challenge when done manually. Other 3D techniques like stereo vision, time of flight and laser triangulation are introduced in greenhouse horticulture to control robots, measure the geometric quality features as flower diameter and bulb orientation or to separate target features from its agricultural surroundings (e.g., Anthurium, chicory, lily bulbs). But also the interest to measure internal quality features as ripeness, food compounds, internal defects and the ability of photosynthesis capacity can be measured by spectral cameras, fluorescence techniques and X-ray. New developments in energy solutions in greenhouses will lead to more profitable options in crop production Various technologies developed are now common practice in greenhouses like the application of thermal screens and temperature integration. More recent developments in humidity control have been adopted further decreasing energy consumption and thereby even increasing production quality and quantity. More futuristic concepts where electricity and heat are produced in combination with greenhouse production are still in the experimental phase. When all new developments lead to products with excellent quality in the right amount, price and ready just in time, products need to be harvested with a predictable capacity and reliability.

Keywords: Horticulture, Innovations, Production, Technologies

ASSAY AND ANALYSIS OF CHILCUV-CP & CHILCUB: EXPRESSWAY FOR IDENTIFICATION OF VIRAL SUPPRESSOR OF RNA SILENCING

ANURAG KUMAR SAHU AND NEETI SANAN-MISHRA*

PLANT RNAI BIOLOGY GROUP, INTERNATIONAL CENTRE FOR GENETIC ENGINEERING AND BIOTECHNOLOGY, NEW DELHI, INDIA.

The chili leaf curl virus (ChiLCuV) and its satellite DNA β (ChiLCu β) have been found to co-exist in the infected plants. This study presents evidence that suppression of PTGS by the sole betasatellite-encoded protein, β C1 is crucial for this association. The ability of the β C1 protein to suppress PTGS was investigated by using in-house developed in planta reversal of silencing assay. The assay was performed in Nicotiana tabacum line harbouring short hairpin GFP and silenced green fluorescent protein (GFP) transgene. Inoculation of _{SH}GFP plants with a recombinant pCAMBIA1302- β C1 resulted in restoration of GFP expression. RT-PCR analysis confirmed that the observed GFP fluorescence was associated with GFP mRNA transcript accumulation. These results indicate that the beatsatellite are involved in overcoming host gene silencing response. Yeast two-hybrid screen identified ChiLCuV-CP as the interacting partner of β C1 protein. Subcellular localization through Confocal analysis, revealed that β C1 was localized in the nucleus of the host cell. **Keywords**: ChiLCu β , transgenic tobacco lines,GFP suppression,Y2H, Confocal analysis

FIELD EFFICACY OF CERTAIN GRANULAR INSECTICIDES AGAINST YELLOW STEM BORER SCIRPOPHAGA INCERTULAS IN PADDY

ARVIND KUMAR, DEVENDRA PAL AND RAM KARAN SINGH

KRISHI VIGYAN KENDRA SAMBHAL (SARDAR VALLABHBHAI PATEL UNIVERSITY OF AGRICULTURE & TECHNOLOGY, MEERUT-250110 U.P.

Paddy (Oryza sativa) is a major edible cereal crop in India and world. Paddy crop is generally affected by a number of insect-pests but Yellow Stem Borer (YSB) is more destructive pest of paddy right from seedling to maturity causes yield losses 27-34% every year. To

control the YSB in paddy farmers are applying a number of granular insecticides but most of them are more toxic and not suitable for IPM system. So now a days, promotion of comparatively less toxic and IPM suitable insecticides is must in paddy growing areas in modern agriculture.For solving this issue Krishi Vigyan Kendra, Moradabad conducted an On Farm Trial during kharif 2014 on farmers field at five different locations, to evaluate the field efficacy of two granular insecticides i.e Cartap hydro-chloride 4G @ 20kg/ha and Fipronil 0.3 G @ 25kg/ha. Both of these insecticides are less toxic and IPM suitable, compared with control (Carbofuran 3CG @ 20kg/ha) which is used by a large number of paddy growers in the district. The result showed that YSB infestation was found 6.25% in Cartap hydrochloride applying fields. It was followed by Fipronil 0.3 G applying fields i.e 8.33% as compare to control (Carbofuran 3 CG) i.e 12.5%. Similarly the highest grain yield (45.0 q/ha) with higher BC ratio (3.03) was obtained by applying Cartap hydrochloride 4G which was 12.5 % more than control (Carbofuran 3 CG). It was followed by applying Fipronil 0.3G (44.0 q/ha) with BC ratio (2.93) which was 10% more than control. However control gave lowest grain yield (40.0 q/ha) with BC ratio (2.71). It was concluded that Cartap hydrochloride 4G is good for higher grain yield, less infestation of YSB and it is also suitable for IPM system.

EFFICACY OF ECOFRIENDLY NATURAL PRODUCTS AGAINST POWDERY MILDEW OF BER

MEERA CHOUDHARY, R.P. GHASOLIA, MANISHA SHIVRAN

DEPARTMENT - PLANT PATHOLOGY, SKN COLLEGE OF AGRICULTURE (SKNAU), JOBNER-303 329, JAIPUR, INDIA

Ber (Ziziphus mauritiana Lamk.) is one of the most common fruit, indigenous to an area joined from India to China. Powdery mildew of ber incited by Oidium erysiphoides f. sp. ziziphi, Yan and Wang is the most important disease that causes maximum reduction in yield and quality of ber fruits. Exclusive reliance on fungicides for the control of disease of various crops resulted in residue and environmental hazards. Therefore, in recent years, efforts are being diverted to employ higher plants, natural products and their derivatives as a tool for integrated disease management because they do not cause bio-accumulation, bio-magnification and environmental pollution. The jujube or ber is an ancient fruit of India and China. It was one of the prominent fruits on which the sages in ancient India lived during the Vedic age and lived even today. Ber is a hardy crop which grown in arid conditions of Rajasthan, characterized by sandy soils, scanty rainfall (400-600mm), thermal oscillations (5-35 °C) and low relative humidity. Therefore, the area of cultivation is increasing in this zone (arid and semi arid) and is expected that in near future ber will be a leading fruit crop of arid zone. The cultivation of ber requires the least input and care. In present investigation six natural products (buffalo milk, cow milk, garlic extract, neem oil, mustard oil, butter milk/chhach) were evaluated for their efficacy against powdery mildew of ber. In natural products maximum intensity over control was observed with garlic extract followed by neem oil, mustard oil, cow milk, buffalo milk and least effective was butter milk. Key words: Ber, Ziziphus mauritiana, powdery mildew, natural products, oils

FARMSCAPING: TO AUGMENT NATURAL ENEMIES DIVERSITY AND ECO-FRIENDLY PEST SUPPRESSION IN OKRA (ABELMOSCHUS ESCULENTUS (L.) MOENCH)

A. MEENA*, R. K. SHARMA, S. CHANDER AND S. R. SINHA

ICAR-INDIAN AGRICULTURAL RESEARCH INSTITUTE. NEW DELHI 110 012 INDIA

Field experiment conducted on flower strip farmscaping along with intercropping to promote natural enemy diversity and eco-friendly pest suppression in okra during kharif, 2016 and 2017. Pooled data of both the years revealed that whitefly was lowest (7.66 /15 leaves) in biopesticides treated okra having baby-corn as an intercrop with flower plants strip. Likewise, a minimum population of leafhoppers (39.89 /15 leaves), red spider mites (99.16 /cm²/15 leaves) and lowest fruit infestation by fruit borer (9.60%) were observed on treated okra having cowpea as an intercrop with flower strip farmscaping. Maximum populations of natural enemies viz., coccinellids (5.40), spiders (6.38), Geocoris bug (2.47), rove beetles (1.99 /5 plants) and carabid beetles (1.32 /2 pitfall traps) were recorded on untreated okra with cowpea intercropping having flower strip farmscaping. Shannon-wiener index value was found lower for pests on okra treatments having flower strips, while index value was higher for natural enemies on same treatments.

Keywords: Farmscaping, Flower strip, Habitat manipulation, IPM, Natural enemies, Okra

LAYER BY LAYER EDIBLE COATING: AN EFFECTIVE TOOL TO MAINTAIN QUALITY AND BIOACTIVE COMPOUND IN FRUITS

NIRMAL KUMAR MEENA^{1*}, VAISHALI GUPTA², HANSRAJ MEENA¹, INDERRAJ GHASIL² **1DEPARTMENT OF FRUIT SCIENCE, COLLEGE OF HORTICULTURE AND FORESTRY, JHALAWAR (AU, KOTA)** 2DEPARTMENT OF POST HARVEST TECHNOLOGY, COLLEGE OF HORTICULTURE AND FORESTRY, JHALAWAR (AU. KOTA)

Postharvest loss during transportation and handling is a major challenge. Owing to high moisture content fresh fruits are more prone to postharvest decay and injuries. This postharvest loss leads to the deterioration of fruits, loss of firmness, loss of glossiness and their inherent phytonutrients. The final consumer quality may not be fitted as per market standards. There are several synthetic coating materials which widely used to coat the fruits but due they may not be safer for health. There are several approaches to replace the currently used commercial synthetic waxes by developing edible natural biodegradable coatings. Now a day, coating of the fruit by combination of two or more materials and layer by layer is gaining attention. Layer by layer coating is a novel method in which first fruit is coated by one coating mixture than after drying of 5-10 minutes second coating material is applied. This method is helpful in preserving the nutrients and many bioactive compounds and extending the shelf life of fruits by one to two weeks. Layer by layer coating with carboxy methyl cellulose and chitosan, CMC and guar gum, CMC and gum acacia are more common for extending the shelf life of strawberry, mango, fresh cut pineapple, ber, sapota and guava. This method provides a stable matrix and high glossiness to the fruits. However, limited research work has been done so far on layer by layer coating application. There is urgent need to develop more suitable coating materials and cheaper effective methodology to improve shelf life and to maintain maximum nutrients.

Keywords: Postharvest loss; layer by layer coatings; shelf life; gum

MORPHO-MOLECULAR STUDIES IN LASIODIPLODIA THEOBROMAE INFECTING SEEDS OF DIFFERENT CROPS

BADRISH TIWARI¹, RAJ KIRAN^{2*}, JAMEEL AKHTAR², AJAY KUMAR¹, PARDEEP KUMAR², MEENA SHEKHAR², SADHANA², KRISHNA NAIR² AND SUNIL CHANDRA DUBEY² ¹DEPARTMENT OF PLANT PROTECTION, CHAUDHARY CHARAN SINGH UNIVERSITY, MEERUT, UTTAR PRADESH-250001

²DIVISION OF PLANT OUARANTINE, ICAR-NBPGR, PUSA CAMPUS, NEW DELHI, INDIA-110012

The fungus Lasiodiplodia theobromae is one of the major economically important plant pathogen known to cause serious post-harvest losses in many crops. Nine monoconidial isolates of L. theobromae purified from infected seeds of five different crops were studied for morpho-molecular variability. The colony colour of isolates were cottony white and greyish, cottony white and smoke grey, cottony white and light greyish and cottony white after 3 days of inoculation, but after twelve days of incubation, colour of all the isolates changed to dark grey and blackish. The immature conidia (single celled) have minimum (9.6 x 5.9 µm) and maximum (12.9 x 6.9 µm) average dimension and length by width ratio of all the isolates were observed between 1.5 to 1.9. Variation in the shape observed as sub ovoid, ovoid and ellipsoid. Whereas minimum average dimension of mature spore (double celled) was 10.44 x 6.71 µm and maximum was 13.15 x 6.79 µm. The range of ratio for conidial length and width was 1.6 to 2.0. Variation in conidial colour was observed as dark brown, cinnamon & dark brown. Spore shape was observed as ovoid and ellipsoid. Using thirteen URP markers, the number of amplified products ranged from 13 to 31. A dendrogram based on molecular data, grouped the isolates into two main clusters with a genetic similarity ranging from 52.7 to 88.6 per cent. The maximum differences in similarity were observed 0.966 among isolates from Haryana, while least similarity were observed 0.432 between Trissur and Tripura. A similar grouping was also evident from the two-dimensional and threedimensional principal component analysis. This study establishes the existence of variability among L. theobromae isolates from different area and provides opportunity to develop management strategy so that post- harvest losses due to this pathogen could be minimized. Keywords: Diversity, Lasiodiplodia theobromae, URP markers.

STUDY OF THE GENETIC AND NON-GENETICS FACTORS AFFECTING THE NET COST OF MILK PRODUCTION OF DAIRY CATTLE IN MADHEPURA DISTRICT OF BIHAR, INDIA.

PRAMOD PRABHAKAR¹, PRAMOD KUMAR² AND M.K. BHARTI³ ¹ANIMAL HUSBANDRY, MBAC, AGWANPUR, SAHARSA (BAU, SABOUR, BHAGALPUR) ²APRI, RPCAU, PUSA ³T.V.O. SAHARSA

Animal husbandry & dairy play an important role in national economy and in socioeconomic development of the country. Animal husbandry output constitutes about 30 per cent of the country's agricultural output. The average gross cost of milk production in Desi, HFX and JX cows were obtained as Rs. 10.311, Rs. 8.535 and Rs. 9.312 respectively. Among various variable cost items, feed cost was found to be the major cost component which contributed 70.817%, 72.700% and 70.929% of their respective gross costs in Desi, HFX and JX cows respectively. The Operation Flood Programme, which is the world's largest integrated dairy development programme, has made considerable progress in achieving its outlined objectives. The second major cost component was observed to be the labour cost which contributed 12.607%, 14.645% and 16.108% of their respective gross costs in Desi, HFX and JX cows respectively. Nutritional benefits and social upliftment are the determinant of our agriculture growth. This success story of milk could have much larger dimensions with the higher population of indigenous cattle come under the umbrella of genetic improvement. Even when the growth in the sector in recent years has partially slowed down than what was seen during the previous two decades yet a growth rate of around four per cent in this sector provides ample testimony to capacity building and contribution of this commodity to the annual national growth.

Keywords: Genetic, Non-genetic, Net cost, Milk Production, Dairy cattle.

PROCESS OPTIMIZATION AND STORAGE STUDIES OF OSMOTIC DEHYDRATED PINEAPPLE FRUIT SLICES WILLIAM SINGH, NAVEET KAUSHAL AND NAMNEET KAUR

DEPARTMENT OF AGRICULTURE, MATA GUJRI COLLEGE, FATEHGARH SAHIB (PUNJAB)

The present investigation entitled "Process optimization and storage studies of osmotic dehydrated pineapple fruit slices" was carried out in Department of Agriculture, Mata Gujri College, Fatehgarh Sahib (Punjab) during the year 2017-18. The experiment was laid out in CRD (Completely Randomized Design) with 10 treatments and 3 replications to evaluate the effect of different soaking treatments viz. 40, 50 and 60° B sucrose solution, brown sugar solution and honey solution for preparation of osmotic dehydrated pineapple fruit slices. Physicochemical parameters viz. moisture, TSS, acidity, ascorbic acid, total sugars and reducing sugar as well as organoleptic attributes viz. colour, flavour, texture and overall acceptability of osmotic dehydrated pineapple fruit slices were evaluated. An overall result of osmotic dehydrated pineapple fruit slices was found better in the treatment T₉ steeping in honey solution (50 °B) proved to be the best in terms of quality as well as sensory score and on economic return on value addition of osmotic dehydrated pineapple fruit slices.

EFFECT OF FOLIAR APPLICATION OF NUTRIENTS ON GROWTH, YIELD AND FRUIT QUALITY OF STRAWBERRY (FRAGARIA × ANANASSA DUCH.) CV. CHANDLER

GURPIAS SINGH, DILIP SINGH KACHWAYA, BAVDEEP SINGH MANJINDER SINGH AND JAGMEET SINGH MATA GUJRI COLLEGE, SRI FATEHGARH SAHIB, PUNJAB -140406

To study the effect of pre-harvest foliar application of nutrients on growth, yield and fruit quality of strawberry (*Fragaria* \times *ananassa* Duch.) cv. Chandler an experiment was conducted at the Agriculture Research Farm, Department of Agriculture, Mata Guiri College, Sri Fatehgarh Sahib, Punjab during the year 2017-18. The experiment was laid out in a Randomized Block Design (RBD) having nine treatments with three replications. Treatments consisted of FeSO₄ (0.4% and 0.6%), ZnSO₄ (0.4% and 0.6%), Ca(NO₃)₂ (0.4% and 0.6%) and Borax (0.1% and 0.2%), while in control water is sprayed. The result revealed that plants treated with 0.6% FeSO4 increase vegetative growth in terms of plant height (20.91 cm), plant spread (31.37 cm), number of leaves per plant (28.50), leaf area (110.00 cm²), leaf area index (3.77), leaf fresh weight per plant (59.38 g) and leaf dry weight per plant (17.11 g). Maximum number of flowers per plant (17.52)

and number of fruits per plant (12.19) also reported in plants treated with 0.6% FeSO₄. However, the plants treated with 0.6% ZnSO₄ increase yield attributes and fruit quality attributes in the terms of fruit weight (13.52 g), fruit length (44.52 mm), fruit breadth (30.64 mm), yield per plant (129.10 g), yield per hectare (6.76 tonnes), TSS (12.67 0 B), ascorbic acid (60.53 mg/100g pulp), total sugar (7.96 %) and lowest acidity (0.78 %). Highest shelf-life of fruits (2.75 days) were recorded in 0.6% Ca(NO₃)₂ treated plants. **Key words:** Strawberry, Growth, Calcium, Iron, Boron, Quality, Shelf-life, Yield, Zinc

IMPACT OF DRIP BIO-FERTIGATION ON SOIL HEALTH, FLOWERING AND YIELD OF STRAWBERRY (*FRAGARIA* × *ANANASSA* DUCH.) CULTIVATED IN CENTRAL PLAIN REGION OF PUNJAB MANJINDER SINGH, DILIP SINGH KACHWAYA, BAVDEEP SINGH, GURPIAS SINGH AND JAGMEET SINGH MATA GUJRI COLLEGE, SRI FATEHGARH SAHIB, PUNJAB -140406

A study was carried out to monitor the impact of drip bio-fertigation on soil health, flowering and yield of strawberry (cv. Chandler) during year 2017-18 in central plain region of Punjab. Experiment laid out in randomized block design with 10 treatments replicated thrice. Treatments comprising full recommended dose of fertilizers (N.P.K- 150.100.120 kg ha⁻¹), 75% recommended dose of fertilizers (N.P.K- 112.75.90 kg ha⁻¹), Arka microbial consortium (AMC) @ 7.5 lit ha⁻¹, Arka microbial consortium (AMC) @ 5 lit ha⁻¹, *Azotobacter* @ 7 Kg ha⁻¹ and PSB @ 7 lit ha⁻¹ alone or in combination were applied after planting through drip system (bio-fertigation). The result revealed that significantly maximum number of flowers plant⁻¹, number of fruits plant⁻¹, yield plant⁻¹ and yield ha⁻¹ they were recorded with the application of T₅ (100% RDF + Arka microbial consortium (AMC) @ 7.5 lit/ ha). However, minimum number of days taken to produce first flowering was also recorded in the plants which were treated with T₅ (100% RDF + Arka microbial consortium (AMC) @ 7.5 lit/ ha). The maximum total microbial population in soil, Soil pH (7.75), Soil EC (0.380 dSm⁻¹) and organic carbon (0.62%) was recorded with the application of T₅ (100% RDF + Arka microbial consortium (AMC) @ 7.5 lit/ ha). The maximum phosphorus content, potassium content in soil was found in T₂ (100% RDF + PSB @ 7 lit/ha) and maximum nitrogen content in soil was found in T₃ (100% RDF + Azotobacter @ 7 Kg/ha) Hence, it could be concluded that the drip bio-fertigation in strawberry is found to be useful for obtaining higher flowering, yield and better soil health.

Key words: Strawberry, RDF, AMC (Arka microbial consortium), *Azotobacter*, PSB, Biofertigation, flowering, yield and total microbial population.

QUALITY OF POMEGRANATE ARILS AFFECTED BY DRYING METHODS (*PUNICA GRANATUM* L.) CV. KANDHARI YASHU GARG, DILIP SINGH KACHWAYA AND BAVDEEP SINGH

DEPARTMENT OF MATA GUJRI COLLEGE, SRI FATEHGARH SAHIB, PUNJAB -140406

The experiment was conducted at the Department of Agriculture, Mata Gujri College, Sri Fatehgarh Sahib, Punjab during 2017-19 to study the quality of Pomegranate arils affected by drying methods (*Punica granatum* L.) cv. Kandhari. Experiment was laid out in Factorial Completely randomized design with 9 treatments replicated thrice. Pomegranate arils were treated with different pre-treatments (Steam blanching for 30 seconds, 1% potassium metabisulphide (KMS) and 100ppm sodium hypochlorite solution) and then dried in open sun drying, solar drying and hot air oven drying. Among different pre-treatments with drying methods, Hot air oven drying with steam blanching for 30 seconds were found to be the best method with respect to colour, texture, taste, aroma, overall acceptability and nutritional parameters.

Keywords: Pomegranate arils, anardana, pre treatments. drying methods, physico-chemical parameters and organoleptic evaluation

MUSHROOM: AN EDIBLE FUNGI

POOJA¹, GARIMA¹, SINTU MALIK², MANJU LOURA¹

¹DEPARTMENT OF BUSINESS MANAGEMENT, CHAUDHARY CHARAN SINGH HARYANA AGRICULTURAL UNIVERSITY, HISAR

²DEPARTMENT OF AGRONOMY, CHAUDHARY CHARAN SINGH HARYANA AGRICULTURAL UNIVERSITY, HISAR

Mushroom is the fleshy, spore bearing fruiting body of a fungus that lacks chlorophyll and obtain their nutrition from metabolizing nonliving organic matter. Mushroom are found in edible, non-edible and poisonous form. According to FAO, world production of mushroom was estimated about 10.2 million tonnes in 2017 and in India it is around 487,000 MT in 2017-18. At Present, about twenty species of mushrooms are being commercially cultivated world over, but significant production is of the Button mushroom (*Agaricus bisporus*), Shiitake (*Lentinula edodes*), Oyster mushroom (*Pleurotus spp.*), Paddy straw mushroom (*Volvariella volvacea*) and Black ear mushroom (*Auricularia polytricha*). There are six steps in cultivation of mushroom reduction are temperature (initially $23 \pm 2^{\circ}$ C for about a week and then $16 \pm 2^{\circ}$ C), moisture (2-3 light sprays per day for moistening the casing layer), humidity (above 85%), proper ventilation and CO₂ concentration (0.08-0.15 %) (National Horticulture Board, Govt. of India). Mushrooms are harvested at the button stage around three weeks after casing. They can be stored in polythene bags at 4-5^o C for 3-4 days and canning, freeze drying, pickling and IQF methods are used for long term storage. Mushrooms are good source of proteins, vitamins, dietary fibres and minerals with low calorific value and no cholesterol. Mushrooms are good source of food for the heart and diabetic patients.

Keyword: white button, spawn, casing, canning, calorific value

EVALUATION OF MICROBIALS AND BOTANICALS ON POPULATION OF (LEDY BIRD BEETLE) IN SOYBEAN G. D. BOCHARE¹ AND S. S. SHINDE²

¹DEPARTMENT OF AGRICULTURAL ENTOMOLOGY, PGI, DR. PANJABRAO DESHMUKH KRISHI VIDYAPEETH, AKOLA

²DEPARTMENT OF AGRICULTURAL ENTOMOLOGY, COLLEGE OF AGRICULTURE, NAGPUR.

The present investigation entitled: "evaluation of microbials and botanicals against defoliators of soybean" was conducted during *Kharif* season of 2016 at Experimental Farm of Department of Entomology, Post Graduate Institute, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola. Treatments reveled that *Beauveria bassiana* and *Nomuraea rileyi* each @ 7.5 g / L and neem seed extract 5 % were most effective in reducing the population of green semilooper and tobacco leaf eating caterpillar as well as registered highest yield of soybean. Dashparni

extract 12.5 ml / l was least effective in reducing the semilooper population and higher yield of soybean. Further, this treatment was not effective against *Spodoptera litura*. The neem seed extract 5 % was economically most effective treatment against soybean defoliators followed by *N. rileyi* @7.5 g/l.

Key word:-Beauveria bassiana, Nomuraea rileyi and ledy bird beetle.

EFFECT OF PUTRESCINE AND NAPHTHALENE ACETIC ACID (NAA) ON GROWTH AND PRODUCTIVITY OF PIGEONPEA

GANESH N. JADHAV¹, RAJENDRA S. WAGH²,

DEPARTMENT OF BOTANY, MAHATMA PHULE KRISHI VIDYAPEETH, RAHURI

The Physiological response of foliar sprays of putrescine (25, 50, 75, 100 and 125 ppm) and NAA (25 and 50 ppm) on the morphophysiological, chemical, biochemical, yield and yield contributing parameters of pigeonpea cv.PKV-Tara was studied during kharif 2016-2017 at farm of Botany section, College of Agriculture, Nagpur.Experiment was laid out in RBD design with three replications and eighteen treatments. Sowing was done by dibbling method on dated 1stJuly 2016 at a spacing of 60 cm x 20 cm. Thereafter all the intercultural operations were done as and when required. The recommended dose of 25 kg N ha⁻¹ and 50 kg P₂O₅ ha⁻¹ was applied in all treatments. Spraying of putrescine and NAA was done two times i.e. on 45 and 65 DAS. Observations about morpho-physiological parameters such as plant height, leaf area and dry weight of plant were recorded at 45, 65, 85 and 105 DAS. RGR and NAR were calculated at 45-65, 65-85 and 85-105 DAS. Plant height was recorded at maturity. Chemical and biochemical parameters like leaf chlorophyll, N, P, K content in leaves, protein content in seed were also estimated. Observations on yield and yield contributing parameters like 100 seed weight, number of pods plant⁻¹, number of seeds pod⁻¹, seed yield plant⁻¹ (g), plot⁻¹ (kg) and ha⁻¹ (q) were recorded. All these above mentioned parameters were analyzed statistically. Foliar sprays of putrescine (25, 50, 75, 100 and 125 ppm) and NAA (25 and 50 ppm) significantly enhanced morpho-physiological parameters viz., plant height, number of branches plant-1, leaf area, dry weight of plant, RGR, NAR, chemical and biochemical parameters viz., nitrogen, phosphorus, potassium, chlorophyll in leaf, protein content in seed, yield and yield contributing parameters viz., 100 seed weight, number of pods plant⁻¹, number of seeds pod⁻¹, seed yield plant⁻¹ (g), plot⁻¹ (kg) and $ha^{-1}(q)$ over control. The highest per cent increase in yield over control was observed in treatment sprayed with 50 ppm NAA + 100 ppm putrescine i.e. 31.36 per cent. Next to this treatment, foliar spray of 50 ppm NAA + 75 ppm putrescine also enhanced yield by 30.26 per cent over control. From overall results, it can be stated that foliar application of growth regulators such as putrescine and NAA with different concentrations improved the morpho-physiological, biochemical and yield and yield contributing parameters might have helped in attaining better seed yield in the present investigation. But, considering the B : C ratio foliar application of 50 ppm NAA + 75 ppm putrescine (T₁₆) was found most effective treatment having B : C ratio of 2.75 as compared to 2.26 in control.

INTEEGRATED PEST MANAGEMENT IN TROPICAL FORESTRY: PERSPECTIVES AND APPROACH

SOMNATH SEN

DEPARTMENT OF FOREST BIOLOGY, TREE IMPROVEMENT AND WILDLIFE SCIENCES, COLLEGE OF FORESTRY, SAM HIGGINBOTTOM UNIVERSITY OF AGRICULTURE, TECHNOLOGY AND SCIENCES, PRAYAGRAJ (ALLAHABAD) UTTER PRADESH -21107 INDIA

Integrated Pest Management (IPM) has been defined in different ways but it essentially involves the use of a combination of pest management strategies to reduce economic losses caused by pests to tolerable levels, with minimal environmental side effects and health hazards, Most successful case studies of IPM instill from Agriculture. Forestry, especially in the tropics, has tended not to implement anything like the complexities of IPM employed in intensive agriculture. A tactic of key importance for forestry is that of prevention and it is essential that Forest Entomologists and Pathologists be involved in the early planning and nursery stages of any new plantation project. There are many challenges in implementing IPM in Forestry. Defining an economic injury level for a long lived perennial crop such as trees is not simple because economic and biological Forecasts sometime need to be made over decades, Defining Economic damage and determining economic threshold are similarly problematic and complicated. Management objectives for a given forest stand need to be clearly defined by managers so that pest impacts can be judged in that context. In monitoring programme is unaffordable, while a shortage of trained protection staff in many developing tropical countries is also a hurdle to the implementation of IPM in India, ICFRE successfully evolved IMP schedules by combining silvicultural and biological control for suppressing epidemic pest population of some major Forest insect pests . Prioritization of procedures based on survey and detection, Silviculture, cultural, regulatory, chemical and bioremediation methods are suggested for successful IPM programme of Forest insect pests.

Key-words: Pest Management, Economic injury level, Economic threshold, Silviculture and Bioremediation.

PROCESS OPTIMIZATION AND PHYSICO-CHEMICAL EVALUATION OF APPLE GINGER BLENDED WINE ALONG WITH DIFFERENT SWEETENING AGENTS

SHIVANI JYOTI, NAVEET KAUSHAL, SANDEEP KAUR, DILIP SINGH KACHWAYA, GURJEEWAN SINGH DEPARTMENT OF AGRICULTURE, MATA GUJRI COLLEGE, FATEHGARH SAHIB, PUNJAB,140406, INDIA

Preparation of wine from surplus apple fruits can reduces postharvest losses besides source of income. Apple ginger wine using different sources of sugars i.e. honey, sugar and stevia to raise the TSS of must to 20°B was prepared as per routine procedure. To impart medicinal value, ginger was added with different concentration to the must. The apparent effect of addition of extract was to delay the fermentation, not to stop it. The effect of fermented apple juice aroma compounds was analysed by Gas Chromatography – Mass Spectrophotometry (GC-MS). Different volatile compounds were found from the apple juice and fermented apple juice and yeast. Physico-chemical characteristics of apple ginger wine before and after fermentation showed that the addition of extract did not affect the quality of wine adversely. From the sensory quality point of view, the extract treated with 6% ginger juice and sugar at 20°B was superior to the 8% ginger juice with 20°B (only stevia) in most of the sensory qualities. The highest score (9) was awarded to 6% ginger juice at 20°B (only sugar)

based wine. The total phenols which are expected to contribute the antimicrobial and antioxidant activities of the wine. Reducing sugars, total sugar, titrable acidity, ethanol and volatile acidity increased significantly while total phenols decreased. **Keywords**: Apple, ginger, wine, sugar, honey, stevia, *Saccharomyces cerevisiae* var. *ellipsoideus*.

STUDIES ON ISOLATION AND FUNCTIONALITY OF STARCH FROM SWEET POTATO (IPOMOEA BATATAS L.)

KALE RV¹, RAUT G.S¹. AND Y.N. PATIL²

¹MGM COLLEGE OF FOOD TECHNOLOGY, AURANGABAD-431002 (MS), INDIA ²MGM NANASAHEB KADAM COLLEGE OF AGRICULTURE, AURANGABAD

Effect of different isolation method on functional properties of Sweet potato starch. Starch was isolated by using distilled water, Sodium chloride and Sodium metabisulfite and compare for yield and recovery. The isolated starch was analyzed for their functional properties such as whiteness, water absorption, paste clarity, solubility and swelling power. Also they were characterized using scanning electron microscope (SEM) and rapid visco-analyser (pasting profile).results revealed that the yield of starch was ranged from 21.59 to 28.50%. The treatment T₁ found to have highest percent of yield and recovery. The functional properties of starches such as water absorption capacity (WAC) was in the range of 0.65-0.74 g/g, paste clarity of sweet potato starch ranged from 33.26 to 35.61%, swelling power of isolated starches at 60° ranges from 4.28 to 4.83 % and Solubility values were ranged from 2.19 - 2.37 % at 60° c. The results obtained by scanning electron micrograph of starches showed that starch shape was varied from round polygonal, spherical and irregular shapes and the particle size was ranges from 10 to 25 µm. The pasting profile of starch from all treatment showed that the peak viscosity, break down, set back viscosity, peak time and peak temperature was found to be 3332.10 to 4679.302, 2051.289 to 2416.583, 891.070 to 1051.566 cp, 4.12 to 4.64min and 67.40 to 78.45^{\circ}C. The T₁ had lowest peak viscosity and average peak temperature.

FUTURE FARMING WITH TECHNOLOGICALLY UPDATED FARMERS

Kiran S C

DEPARTMENT OF FORESTRY AND ENVIRONMENTAL SCIENCE, UNIVERSITY OF AGRICULTURAL SCIENCE GKVK BENGALURU

Agriculture 4.0 is the best alternative or initiative to future farming which is no longer depend on applying water, fertilizers, and pesticides uniformly across entire fields. Instead, farmers will use the minimum quantities of inputs and very target specific areas with better updated technology. The agricultural operations by well-advanced farmers will have to be run with future planning, primarily by advancements in technology such as sensors, devices, machines, and information technology. Future farmers have to use sophisticated technologies such as robots, temperature and moisture sensors, aerial images, and GPS technology. The advanced devices, precision agriculture and robotics will allow farmers to be more profitable and these to be reachable for farmers at a low cost with easy operation, efficient, safe, and environmentally friendly. With all these updated technologies increasing number of corporate and financial actors who seek to solve the food crisis. These technologies are envisaged as being part of what is being called the "fourth industrial revolution". The "answer" here is thought to lie in a fusion of technologies that blurs the lines between physical, digital and biological domains in the farming sector. High-yield agriculture may be key to feeding a future alarming population. Currently, vertical outdoor farms and indoor farm factories are the best alternative paths to train the farmers for future prospective.

NUTRIENT RELEASE BEHAVIOUR OF NOVEL ZINC LOADED NANO CLAY BIOPOLYMER COMPOSITES IN WATER MD. BASIT RAZA^{*1}, S.P. DATTA¹, M.C. MEENA¹, RUMA DAS¹, VIVEK KR. TRIVEDI¹, ANIL KR. VERMA¹ AND DEBASIS GOLUI¹

DIVISION OF SOIL SCIENCE AND AGRICULTURAL CHEMISTRY, ICAR-INDIAN AGRICULTURAL RESEARCH INSTITUTE, NEW DELHI

The extent of deficiency of zinc (Zn) is most widespread among all micronutrients. On an average around 36.5% of Indian soils are deficient in Zn. In addition to low total Zn content in soil, abysmally poor use efficiency of Zn (<2%) applied through soluble conventional fertilizer sources has aggravated the problem of Zn deficiency. In order to tackle this problem, novel nano clay biopolymer composites (NCBPCs) were synthesised by substituting synthetic part with natural polymer. These were loaded with Zn and in order to assess the nutrient release behaviour, incubation study in water was conducted. Results indicated that there was a gradual increase in extent of Zn release due to increase in substitution of synthetic part with natural polymer in biopolymer composites. Fitting of Zn release data to parabolic diffusion equation indicated that Zn release from polymer composites is diffusion controlled. This property of polymer composite is desirable to qualify as slow release fertilizer product. The release of Zn from polymer composites with time is one of the most important aspects of polymer composites which ultimately decided the efficacy of such slow release fertilizer products.

EMPOWERING WOMEN THROUGH AGRICULTURAL INNOVATION SYSTEM (AIS) PERSPECTIVE REMA DAS* DEPARTMENT OF AGRICULTURAL EXTENSION, BIRSA AGRICULTURAL UNIVERSITY, K

DEPARTMENT OF AGRICULTURAL EXTENSION, BIRSA AGRICULTURAL UNIVERSITY, KANKE, RANCHI (JHARKHAND)

Women empowerment through increasing the access of resources in local situation is the highlighted issue in the present context. To promote gender equality and women empowerment in agricultural research and development there is a need for active participation of women in various domains of an Agricultural Innovation System (AIS). This paper presents evolution of Innovation System and conceptual framework of an Agricultural Innovation System (AIS). It also describes different stakeholders or actors of an AIS, institutions, organizations, linkages, partnership and interaction among those stakeholders associated with the generation, dissemination, diffusion and application of agricultural innovations at different levels (national, regional, local level). Changes in the demand for innovation present both the challenges and opportunities for agricultural innovation system. In Agriculture sector, adoption of innovation by consumers and society is the main challenge as agriculture is facing global issues like food security, nutritional security, climate change and globalization, which require international co-operation. Agricultural innovation system is broader in scope and more complex as compared to traditional transfer of technology system. The dimension of agricultural innovation always prefers to go along with the concepts of the dynamics

around different activities and roles that poor women communities engaging towards addressing their social and economic needs through agricultural production and marketing system. Hence, emphasis has been given on the role of innovations towards empowering women including several strategies for capacity building of women actors within an AIS.

Key words: Agricultural innovation system, Innovations, Stakeholders, Women Empowerment.

CONSERVATION AGRICULTURE – AN APPROACH TOWARDS SUSTAINABILITY ASISAN MINZ* DEPARTMENT OF SOIL SCIENCE AND AGRICULTURAL CHEMISTRY, BIRSA AGRICULTURAL UNIVERSITY, KANKE, RANCHI, (JHARKHAND)

Conservation agriculture (CA) offers a new ideal approach for agricultural research and development different from the conventional one, which mainly based on the minimal soil disturbance (no-till) and permanent soil cover (mulch) combined with crop rotations, as a more sustainable cultivation system for the future to boost agricultural production by optimizing the use of farm resources and helping to reduce widespread land degradation through the integrated management of available soil, water and biological resources combined with external inputs. Conservation agriculture also helps to provide opportunities to reduce costs of production, save water and nutrients, saving time, increasing yield through timelier planting, reducing diseases and pests and improve efficient use of resources, through stimulation of biological diversity, and reducing greenhouse gas emissions. However, there are still constraints for promotion and adoption of conservation agriculture technologies, such as lack of appropriate seeders especially for small and medium scale farmers, management and competition of crop residues between conservation agriculture use and livestock feeding, burning of crop residues, availability of skilled and scientific manpower and tillage practices. Availability and suitability of proper equipment is a major constraint against successful conservation agriculture. Promoting and adopting conservation agriculture management systems can help to produce more food from less land through more efficient use of natural resources and with minimal impact on the environment in order to meet growing population demands.

Key words: Conservation agriculture, Conventional agriculture, Benefits, Constraints, Natural resources management

EXPLORATION OF ICHTHYOFAUNAL DIVERSITY AND THEIR CONVERSATION STATUS OF GHAGHRA RIVER DINESH KUMAR, LAXMI PRASAD, ASHISH KUMAR MAURYA, C. P. SINGH AND S. K. VERMA COLLEGE OF FISHERIES, ACHARYA NARENDRA DEVA UNIVERSITY OF AGRICULTURE AND TECHNOLOGY, KUMARGANJ, AYODHYA- 224229 (U.P.)

The present study was carried out from March 2017 to October 2018 at selected locations including Girja Barrage (Bahraich), Ghaghra Ghat (Bahraich) and Ayodhya (Guptar Ghat) to explore the native and exotic fish fauna of the Ghaghra River. A total of 72 fish species including indigenous as well as exotic, belonging to 26 families and 8 orders have been reported during the present study. Maximum diversity was observed in the family Cyprinidae, represented by 25 species. Among the recorded fish species, 31 species recorded as least concern, 13 species as lower risk, 11 species as vulnerable, 6 species as not accessed, 6 species as not evaluated, 4 species as endangered and 1 species as near threatened according to IUCN status. Our study result reveals that the river supports considerable diversity of the fishes and is important for conservation as some fish fauna is threatened being either vulnerable or endangered. However strategies such as sustainable harvesting, control on introduction of exotic species, check on water pollution and regulation of destructive fishing methods are suggested for conservation of the native and endemic fish species of the river.

Key words: Ichthyofaunal diversity, Ghaghra River, IUCN status, Exotic fishes, Indigenous fishes.

ULTRASOUND ASSISTED FORMATION AND STABILITY OF W/O NANO-EMULSION OF CITRUS PEEL EXTRACT IN MUSTARD OIL: OPTIMIZATION THROUGH RESPONSE SURFACE METHODOLOGY JYOTI NISHAD AND CHARANJIT KAUR*

DIVISION OF FOOD SCIENCE AND POSTHARVEST TECHNOLOGY, ICAR-IARI, NEW DELHI-110012

Citrus peels are a rich source of phenolic bioactives which can be effectively used in high lipid containing foods to enhance their oxidative stability. Water in oil emulsion encapsulates the water soluble bioactive extract and demonstrates higher stability and facilitates miscibility in oils. For achieving stable emulsion with desirable properties, the composition of citrus peel extract in oil was optimized using Response surface methodology (RSM) through ultrasonication method. The selected process variables were amplitude, emulsifier and sonication time and the examined response was mean particle size. The characteristics of water-in oil emulsion were significantly influenced by composition variables. A minimum droplet size of 29.73 nm was achieved at ultrasonication at 30.12% amplitude for 9.49 min of sonication with 0.52% of emulsifier (span -80). Formation of nano-emulsion was further confirmed by TEM. It was observed that optimized nano-emulsion based on citrus peel had higher kinetic stability under centrifuge and thermal stress conditions. Thus it seems that ultrasonication can be successfully used to develop nano-emulsion of water soluble extracts and permit there use for functionalization of foods.

Key words: citrus peel, nano-emulsion, mustard oil, ultrasonication

A STUDY ON ADOPTION OF DRUDGERY REDUCING TECHNOLOGIES BY FARM WOMEN IN NAINITAL DISTRICT OF UTTARAKHAND.

POOJA KOHLI¹, DR. V.L.V. KAMESWARI² AND DR.PRIYANKA N. RUBALI³

^{1,3}DEPT. OF SOCIOLOGY, DSB CAMPUS, NAINITAL

²DEPT. OF AGRICULTURAL COMMUNICATION G. B. PANT UNIVERSITY OF AGRICULTURE AND TECHNOLOGY, PANTNAGAR

Women constitute bulk of the world's food producers by predominate the agricultural sector in terms of numbers and tasks performed. The important of improved technology to agricultural development especially in less developed countries is widely recognized. Thus, it was felt necessary to study the various gender friendly equipments adopted by women farmers and constraints faced by the women. This will help government and technology developer to promote these equipments in villages and popularize the same. The study was conducted in two districts; viz; Udham Singh Nagar and Nainital in Kumaon region of Uttarakhand. From Udham Singh Nagar district Gadarpur block was

selected and from Nainital district Bhimtal block was selected. Jainagar village from Gadarpur block and Dogra village from Bhimtal block were selected purposively. Pre-tested interview schedule was administered to 114 respondents for collection of data. The analytical research design was used to meet the objectives of the study. On the basis of the findings it was concluded that majority of respondents were middle aged. Majority of the respondents were illiterate and belonged to small size nuclear family. Majority of the respondents belonged to upper caste, their primary occupation were cultivation and belonged to APL (above poverty line) category. It was found that majority of the respondents had small land holding. It was also found that majority of respondents had medium level of mass media participation and social participation. Majority of respondents had low extension agency contact and medium levels of risk taking ability and change proneness. The extent of adoption of drudgery reducing technologies was very low as reflected from findings. The findings provide an in-depth understanding about extent of adoption of drudgery reducing technologies by farm women which would help extension agencies to redesign their activities for the transfer of technologies related to drudgery reduction of farm women. Also it will be excellent source to the extension students as reference material since very few studies are available on adoption of drudgery reducing technologies **Keywords**: Agriculture, Drudgery, Innovation, Technology,

ESTIMATION OF SUGAR PROFILING AND NITRATE CONTENT IN ONION GENOTYPES DURING STORAGE AT HIGH ALTITUDE LEH-LADAKH REGION

VIVEK KUMAR TIWARI, THUPSTAN TSEWANG, KAUSHAL KUMAR, SOMEN ACHARYA, NARENDRA SINGH AND O. P. CHAURASIYA

DEFENCE INSTITUTE OF HIGH ALTITUDE RESEARCH (DIHAR)-DRDO, LEH-LADAKH (U.T.)

An experiment was conducted in Defence Institute of High Altitude Research, Leh to evaluate the content of different carbohydrates viz. reducing (glucose and fructose), non-reducing (sucrose) and nitrate. Leh-Ladakh is a high altitude cold desert region of our country and is considered as one of most difficult landscape in the world. In this area, during winter's season minimum temperature has been recorded as low as -30°C to -35°C. Onion is one of the most important crops among vegetables. After cropping period, onion is harvested and stored in the month of October. However, prevailing very low temperature in night, heavy snowfall and dry cold wind are limiting factors for onion under storage condition in hills of Leh-Ladakh region. In the present study, onions were stored in semi-underground passive storage structure. Under the storage condition, carbohydrate compositions of 12 onion genotypes were evaluated after one month of storage. Maximum content of glucose (4.66 g/100 g) and fructose (2.92 g/100 g) has been recorded in Prasiddhi KSP-117 and Agrifound Light Red respectively, followed by DOGR (HYB)-50 and local collection. Whereas, minimum glucose (1.19 g/100 g), fructose (1.07 g/100 g) and sucrose (0.52 g/100 g) content has been observed in local collection, Bheema Shakti and Brown Spanish respectively. However, in storage conditions Bheema Kiran exhibited highest sucrose content (3.45 g/100g). Total sugar content (9.17g/100g) was found highest in Bheema Kiran followed by Prasiddhi KSP-117 (8.97 g/100g) and Agrifound Dark Red (8.14 g/100g). Nitrate content of the onion varieties were also estimated and DOGR (HYB)-50 was exhibited maximum nitrate content (83 mg/100g). The minimum nitrate content (58 mg/100g) was recorded in Agrifound Light Red.

Keywords: Onion genotypes, Carbohydrate, Nitrate, Storage

STUDIES ON SENSORY EVALUATION OF DIABETIC SHRIKHAND BY USING JAMUN (Syzygium Cumini L.) PULP Y. N. PATIL , P. V. PADGHAN, P. B. CHAVAN, AND P. B. MESHRAM

^{*1}DEPARTMENT OF ANIMAL HUSBANDRY AND DAIRY SCIENCE, MGM NANASAHEB KADAM COLLEGE OF AGRICULTURE, GANDHELI, AURNAGABAD-431007, M.S.

^{2,4}DEPARTMENT OF ANIMAL HUSBANDRY AND DAIRY SCIENCE, COLLEGE OF AGRICULTURE, LATUR-413512, M.S. ³DEPARTMENT OF ANIMAL HUSBANDRY AND DAIRY SCIENCE, COLLEGE OF AGRICULTURE, LATUR-413512, M.S., INDIA VNMKV, PARBHANI- 431402, M.S., INDIA

Shrikhand was prepared by using *jamun* pulp at 10 per cent, 20 per cent and 30 per cent on the weight basis of chakka with 40 per cent sugar. The main aim of using *jamun* pulp was to harvest and conserve the medicinal properties of *jamun* specially antidiabetic and used of a major and cheap source of manganese, calcium, iron, potassium and sodium. It is well known that inclusion of *jamun* in your diet and it may naturally reduce the amount of sugar in blood. The product obtained was subjected for sensory evaluation by panel of judges. It was observed that the colour and appearance score for treatment T₀, T₁, T₂ and T₃ was 7.63, 7.50, 8.00 and 8.50, respectively. Flavour score was 8.13, 8.00, 8.25 and 8.38, respectively. Taste score was 8.13, 7.75, 8.00 and 8.25, respectively. Consistency score was 8.25, 7.75, 7.75 and 7.75, respectively. Overall acceptability scores for sensory was 8.03, 7.75, 8.00 and 8.22, respectively. Sensory parameters of *shrikhand* i.e. Colour and appearance, flavour, taste and overall acceptability was increased progressively in all treatments but consistency goes on decreased and remain constant for *jamun* pulp added *shrikhand*.

Key word: Shrikhand, Jamun pulp, Sensory quality

NEED OF NATURAL RESOURCE MANAGEMENT AND CONSERVATION AGRICULTURE IN INDIA ABHILASHA¹, BHAGYASHREE¹, SAROJ AMRIT PRIYA¹, CHICHILI JYOSHNA², SRINIDHI P² ¹DEPARTMENT OF AGRONOMY, ²DEPARTMENT OF SOIL SCIENCE & AGRICULTURAL CHEMISTRY INSTITUTE OF AGRICULTURAL SCIENCES, BANARAS HINDU UNIVERSITY, VARANASI-221005

Fresh water, clean air, healthy soils, and ecosystems are cornerstone of sustainable agriculture systems. Natural resources (land, water, biodiversity and genetic resources, biomass resources, forests, livestock and fisheries) the very foundation of human survival, progress and prosperity, have been degrading fast and the pace of their erosion is one of the root causes of agrarian crisis that country is facing. The demographic and socio-economic pressures not withstanding, the unmindful agricultural intensification, over use of marginal lands, imbalanced use of fertilizers, organic matter depletion and deteriorating soil health, misuse and inefficient use of irrigation water, depleting aquifers, salinization of fertile lands and water logging, deforestation, biodiversity loss genetic erosion, and climate change are the main underlying causes. Of the country's total 142 mha cultivated land, 57 mha, 40 % of the total is irrigated and the remaining 85 mha is rainfed. Of the total geographical area of 329 mha, about 146 mha is classified as degraded, although varying estimates have been provided by different agencies. Conservation agriculture technologies involve minimum soil disturbance, permanent soil cover through crop residues or cover crops, and crop rotations for achieving higher productivity. It was observed that 25-30 % cost taken in land preparation than other

operation that can be reduced only by using high conservation tillage practice like adopting of zero tillage, minimum tillage etc. Continuing using of heavy machine and improper agricultural practices and impact on environment losses can be rectified by only conservation agriculture practices. The objective is to leave as many residues as possible in order to increase soil organic matter and to spread them as evenly as possible. Presently farmers are facing the problem of labour shortage can be reduced by conservation tillage practice. Key words- Conservation Agriculture, Biodiversity, Genetic Resource.

ASSESSMENT OF FARM MECHANIZATION INDICATORS IN BUNDELKHAND ZONE OF UTTAR PRADESH, INDIA

TARUN KUMAR MAHESHWARI AND ASHOK TRIPATHI

FARM MACHINERY AND POWER ENGINEERING. VSAET. SAM HIGGINBOTTOM UNIVERSITY OF AGRICULTURE. TECHNOLOGY AND SCIENCES (SHUATS), ALLAHABAD-211 007, UP, INDIA

UP is the fifth largest state of India (24.1 million hectares) with a projected population of 220.7 million people (roughly 16.7 percent of all-India population) in 2016. It is also one of the poorest states in India with 29.4 percent of its population below the poverty line (Tendulkar Poverty Line, 2011-12). Agriculture forms an integral part of UP's economy and the lives of its people. Nearly 69 percent of land in the state is under cultivation. The state is also divided into 9 agro-climatic zones. Agriculture in Bundelkhand Zone was vastly rain-dependent, diverse, complex, underinvested, risky and vulnerable mainly because of its geographical condition. A sizeable area of 84% was allocated to food grain crops in this region. Unlike other regions pulses occupied large share i.e. 43% in GCA. Among the cereals wheat was the important crop although its area remained static. This region is lagging far behind in the adoption of the improved varieties and application of fertilizer. The district selected from Bundelkhand agro-climatic zone of Uttar Pradesh was Jhansi and Chitrakoot. Primary data were collected from 100 farmers from 10 villages of 2 districts i.e. 50 farmers from each district. In India, there is a need to increase the availability of farm power from 2.02 kW per ha (2016-17) to 4.0 kW per ha by the end of 2030 to cope up with increasing demand of food grains. The average value of mechanization index, power availability, cropping intensity, irrigation intensity, annual farmer income, annual input cost, human energy, mechanical energy, total energy in Bundelkhand Zone of Uttar Pradesh year 2018-19 were in 0.92, 1.61 kW/ha, 124.59%, 124.59%, Rs.119852, Rs.32463, 26.63 kWh/ha, 400.31 kWh/ha and 426.94 kWh/ha respectively. Still the harvesting with harvesting worker is maximum mechanize i.e. 0.993 then cultivator as well as diesel engine both had almost same value of degree of mechanization i.e. 0.469 and 0.466 respectively.

Keywords: Mechanization Index, Farm Power, Degree of Mechanization, Cropping Intensity, Human Energy, Mechanical Energy, Total Energy.

EFFECT OF DIFFERENT LEVEL OF MUSHROOM (AGARICUS BISPORUS) AND PROBIOTICS (SACCHAROMYCES CEREVISIAE) ON SENSORY EVALUATION OF BROILER MEAT

RAJ KUMAR^{1*}, NAZIM ALI², D. S. SAHU³, DEBASHIS ROY⁴ AND DEEPAK SINGH⁵ 1*SCHOOL OF AGRICULTURE SCIENCE, RAFFLES UNIVERSITY, NEEMRANA, ALWAR (RAJ)-301705 2,3,4,5SARDAR VALLABHBHAI PATEL UNIVERSITY OF AGRICULTURE AND TECHNOLOGY, MEERUT- 250 110, U.P.

The aim of this study was to investigate the effect of mushroom (Agaricus bisporus) and probiotic (Saccharomyces cerevisiae) as feed additives on sensory evaluation of broiler meat. Three hundred and sixty, day-old broiler chicken (Cobb 400 strain) was divided randomly into eight groups. Each represented a treatment (45 birds/ treatment) with 3 replicates in a completely randomized design. Different levels of mushroom and probiotic had a significant improvement in meat Color/appearance, juiciness, taste, dour and overall acceptability were used as the sensory parameters of all groups. It was observed that improvement of appearance/colour and flavor in meat samples were recorded in the probiotics supplemented group (T_7) whereas lower colour in control group (T_1) . The best odor of meat sample was recorded in the probiotics supplemented group (T_6) whereas poor odor in control group (T_1) . The highest juiciness of meat sample was recorded in the combination of mushroom and probiotics supplemented group (T_8) whereas lowest juiciness in control group (T_1) and The Overall acceptability of meat sample was recorded in the probiotics supplemented group (T_7) whereas lower overall acceptability in control group (T_1) . Application of mushroom in group (T_4) and probiotics in group (T_7) in feed improved the meat quality. The overall acceptability and best meat quality was observed in group (T7) contain 0.3% probiotics. This indicated that sensory evaluation of broiler meat was improved with supplementation of different levels of mushroom powder and probiotics.

Key words: broilers, mushroom, probiotics, sensory.

CROP WEATHER RELATION IN KHARIF RICE FOR CHHATTISGARH PLAINS

KRISHNA MURARI, DR. GK DAS, JUBLI SAHU AND DR. HV PURANIK DEPARTMENT OF METEOROLOGY IGKV, RAIPUR (C.G)

Studies on crop weather relationship in rice were carried out kharif 2016 at Indira Gandhi Krishi Vishwavidyalaya, Raipur Chhattisgarh. Three rice varieties viz. Swarna, Mahamaya and MTU-1010 were grown under irrigated conditions with three dates of sowing viz. and D1(01June2016), D2 (15June2016) and D3 (30 June2016). The cumulative growing degree days at maturity stage were highest (2724) for Swarna fertilized @ 100:60:40 kg NPK-1 and Swarna fertilized @ 60:40:40kg NPK-1under 01st June sowing. Maximum growing degree days were observed in early sown crop 1st June as compared to late sown crop 15th June and 30th June. At maturity stage, the maximum helio thermal unit of 13247, 13247, 11122 and 10366 was recorded for varieties Swarna fertilized @ 100:60:40 kg NPK-1, Swarna 60:40:40, Mahamaya and MTU-1010 respectively sown on 01st June was recorded. The maximum photo thermal unit of 34283, 34283, 31556 and 28914 was recorded for four varieties viz. Swarna fertilized @ 100:60:40 kg NPK-1 and Swarna fertilized @ 60:40:40 kg NPK-1 , Mahamaya and MTU-1010 sown on 01st June respectively. The highest radiation use efficiency was recorded at maturity stage with MTU-1010 (1.52gMJ-1) where as the heat use efficiency was higher in D2 (15stJune) sowing (0.58g/m2 / 0day). The highest HUE was found in variety Swarna fertilized @ 60:40:40kg NPK-1 (0.58g/m2 / 0day).

Keywords: GDD, HTU, PTU, RUE, HUE rice crop, Chhattisgarh state, sowing dates

DESIGN AND DEVELOPMENT OF SUGARCANE HARVESTER FOR SMALL AND MARGINAL FARMER

MD. TAHSIN ASHRAF¹, D. K. ROY² AND R.K. NAIK3³

DEPARTMENT OF FARM MACHINERY AND POWER ENGINEERING, IGKV, RAIPUR, CHHATTISGARH DEPARTMENT OF FARM MACHINERY AND POWER ENGINEERING, SK CARS, KAWARDHA, IGKV, RAIPUR, CHHATTISGARH

DEPARTMENT OF FARM MACHINERY AND POWER ENGINEERING, IGKV, RAIPUR, CHHATTISGARH

The shortage of labour during harvesting season and the various types of harvester were available in the market, but they are costly (about 1.2 crore) and has been designed and develop a sugarcane harvester for small and large farmers at an affordable cost. The harvester consisted of main parts main frame, engine (3.73 kW), gear box (20:1), counter shaft, horizontal shaft, vertical shaft, cutter, handle and ground wheel. In sugarcane harvester, power transfer from engine to the cutter and ground wheel through the counter shaft, horizontal, vertical shaft with the help of bevel gear. The weight of the harvester with the engine is 60 kg. It was found that the sugarcane harvester gave 0.1303 ha/h average effective field capacity and 78 per cent field efficiency with minimum labour requirements (5 man-h/ha) as compared to the traditional method of harvesting. The cost of operation was found to be Rs /ha 2067.60/ which was the lowest from traditional (Rs /ha 11200/) with additional saving (Rs /ha 9132/) and total harvesting losses was 2.69 per cent in case of sugarcane harvester.

Key words - Sugarcane harvester, engine, gear box, bevel gear, cutter, shaft and pulley.

CORRELATION AND PATH COEFFICIENT ANALYSIS FOR QUANTITATIVE TRAITS IN FORAGE SORGHUM [SORGHUM BICOLOR (L.) MOENCH]

ROHIT KUMAR¹, VIJAYA NAND PATHAK², VIKASH YADAV¹ AND ANIL KUMAR³ DEPARTMENT OF GENETICS AND PLANT BREEDING, CSAUA&T, KANPUR, UTTAR PRADESH¹, S M M TOWN P G COLLEGE, BALLIA, UTTAR PRADESH², SVPUA&T, MEERUT, UTTAR PRADESH³

Forage sorghum germplasm field experiment was conducted during *kharif* season 2017 at Crop Research Centre of Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut. Thirty genotypes was undertaken to examine the genotypic and phenotypic correlations and path analysis among agronomic traits. All the thirty forage sorghum genotypes were tested in randomized block design with three replications during *Kharif* season. Correlation coefficient studies indicated that phenotypic coefficient and genotypic coefficients for most of the characters, indicating the expression of the association among the various traits. Green fodder yield recorded significant and strong positive correlation with leaf area at both genotypic and phenotypic level. Therefore, this character is useful to the breeders in selecting suitable plant type. High heritability coupled with high genetic advance were revealed for plant height, leaf breadth, leaf area, leaf stem ratio and green fodder yield, which indicates that preponderance of additive gene effects for these attributes and hence may prove useful for effective selection. Path coefficient analysis exhibited high positive and direct influence of plant height, leaf breadth, stem girth and leaf stem ratio towards green fodder yield. In order to exercise a suitable selection programme it would be worth to concentrate on characters like plant height, leaf breadth, stem girth and leaf stem ratio controlling green fodder yield directly and days to 50% flowering and number of leaf area governing green fodder yield indirectly.

Key words: Correlation and path coefficient analysis in forage sorghum

MOLECULAR PHYLOGENETIC ANALYSIS OF WILD AND CULTURED CIRRHINUS MRIGALA (HAMILTON 1822) NISHA RANA AND SEEMA JAIN

R G P G COLLEGE, MEERUT

The present study was conducted on Phylogenetic Analysis of *Cirrhinus mrigala* collected from different sites of Western Uttar Pradesh. DNA extraction was done and gel electrophoresis was carried out. Mitochondrial DNA of taxonomic importance like 16 S rRNA gene and Cytochrome Oxidase subunit I gene was amplified using available primers, and sequenced. The Phylogenetic analyses of all the sequences were performed using software MEGA 7.0. The results revealed that the molecular data based on 16 S rRNA and COI gene sequences was close to topotype population. The cryptic samples and other fish were identified and characterized based on gene studies viz. 16S, COI, showed maximum similitude to gene sequences of gene sequence available on NCBI *Cirrhinus mrigala* and hence considered as the same. **Keywords**: Phylogenetic Analysis, DNA extraction, *Cirrhinus mrigala*, 16 S rRNA, COI gene.

ASSESSMENT OF TREES OUTSIDE FORESTS IN BALLIA DISTRICT OF EASTERN UTTAR PRADESH

ANUBHA SRIVASTAV, HARI OM SHUKLA , ANITA TOMAR AND AMIT KUMAR KUSHWAHA FOREST RESEARCH CENTRE FOR ECO-REHABILITATION, PRAYAGRAJ

In India, the Eastern region of Uttar Pradesh is still lacking massive tree plantations on farm lands. Insufficient knowledge of suitable tree species and their proper combination with agricultural crops; unorganized and fragmented marketing facilities of the tree produce are the major hurdles in the way to success. Thus, this study has been undertaken with a view to assess status of important tree species outside forests *viz. Tectona grandis* (Teak), *Dalbergia sissoo* (Shisham), *Mangifera indica* (Mango), *Azadirachta indica* (Neem), *Madhuca longifolia* (Mahua), *Eucalyptus sp.*(Eucalyptus), *Phyllanthus emblica* (Aonla) in Ballia district of the region for identification of deficit tree species of the region and recommending them in future afforestation programmes. There are 17 developmental blocks in the district and out of 2372 villages, 1.0 % villages were randomly selected. The status of selected tree species were assessed on the basis of classifying into different diameter classes at an interval of 10 cm from 0-100 cm. The existing plantations of these species showed that Mango (14%) , Teak (19%), Shisham (14%) Neem (17%) and Eucalyptus (11%) were planted in the villages. The status of other species as Mahua (3%) and Aonla (2%) were lower in number and rest 20 % plantations were covered by other important timber species. Most of the Teak trees were in diameter class 0-10 cm (32%), In case of Mango, mostly trees were in girth classes of 11-20 cm (21%). It is also worth mention

here that new plantations of Mango were of 'Kalmi' variety and 'Deshi' variety has become negligible in plantations. Similarly, majority of Neem trees were existing in girth class of 21-30 cm (26%) and in case of Mahua most of the trees were in girth class of 31- 40 cm (30%). It is clear from the existing status of these tree species in Ballia district of the region that to maintain sustainable availability of these species in future, massive plantations of these species in agroforestry/orchards through farmers, NGOs and other plantation agencies are urgent need of time. It was concluded from the results that status of agroforestry in the studied zonal area of the region is in developing stage and needs to be improved by imparting technical knowledge about planting material, methods and sale of end produces of trees to the farmers and tree growers.

Keywords: Tree species, diameter class, agroforestry, , sustainable availability)

GENDER PERFORMANCE IN IRRIGATION INDEX (GPII) AND AGRICULTURE INDEX (GAI) IN CANAL, RIVER LIFT AND GROUNDWATER IRRIGATION PROJECTS IN BIRBHUM DISTRICT OF WEST BENGAL

GOLAM TORAB ALI¹ AND SOUVIK GHOSH²

¹DEPARTMENT OF AGRICULTURAL EXTENSION, UTTAR BANGA KRISHI VISWA VIDYALA, COOCH BEHAR, WEST BENGAL

²DEPARTMENT OF AGRICULTURAL EXTENSION, INSTITUTE OF AGRICULTURE, VISVA-BHARATI UNIVERSITY, SRINIKETAN, WEST BENGAL

Gender performance in irrigation was assessed based on an index developed by the International Water Management Institute (2002). The extent of women empowerment was assessed with the help of gender in agriculture index developed by International Food Policy Research Institute (2012). Present study was conducted in Birbhum district of West Bengal covering 40 farmers each represented from canal, river lift and groundwater lift irrigation command areas, respectively. In case of the river lift irrigation, majority of the farmers perceived that gender based differences are absent (+) with respect to seven out of eight parameters in GPII. The farmers perceived that mild / moderate gender-based differences exists (+/–) with respect to difference in functioning of women leaders in comparison to male leaders. Similar trend is observed in case of groundwater irrigated area. Empowerment of farm women farmers is not visible in canal and river lift irrigation command area as very few farmers have agreed with most of the domains of empowerment; although leadership and income domains of women empowerment were agreed upon by most of the farmers but rest three domains such as production, resources and time were not agreed by most of the respondent farmers. The scenario is found to be contrasting in selected groundwater irrigation area as most of the domains of empowerment (except the resources domain) were agreed upon by the most of the farmers. The presence of tribal farmers (half of the respondent-farmers in present study) may be attributed to existence of women empowerment in agriculture in selected groundwater irrigated area in Illambazar block in Birbhum district of West Bengal.

Key words: Canal irrigation, river lift irrigation, groundwater irrigation, Gender, Irrigation Index, Agriculture Index

EFFECT OF BOTTLE GOURD PULP ON SENSORY QUALITY AND PROXIMATE

COMPOSITION OF COW MILK BUEFI

SUCHITA BHOSALE

MAHATMA PHULE KRISHI VIDYAPEETH ,RAHURI, AHMEDNAGAR

The research work on effect of different combinations of bottle gourd pulp on sensory quality, proximate composition of cow milk burfi was conducted during 2016-2017 in the department of Animal Husbandry and Dairying at College of Agriculture, Nagpur. The different concentrations of bottle gourd pulp were T1 (0%),T2 (05%),T3(10%) and T4 (15%). 30 per cent constant rate sugar was mixed in a khoa for preparation of burfi. The different levels of bottle gourd pulp had a definite effect on improving the sensory quality like flavour, body and texture ,colour and appearance also on overall acceptability of bottle gourd burfi. The score regarding the quality of cow milk burfi showed that the burfi prepared by utilizing cow milk khoa with 15 per cent bottle gourd pulp had secured highest score (8.86) and ranked as most acceptable product. Similarly chemical properties viz., moisture, solids not fat significantly increased by treatment (85% khoa+15% bottle gourd pulp) when compared with control and other remaining treatments but fat, protein ,total solids, ash significantly decreased by the addition of increasing concentration (0-15%) of bottle gourd pulp. The cost of production of burfi was decreased with the increase in the levels of bottle gourd pulp. The cost of roduction in T1 without addition of bottle gourd pulp was Rs. 354.02 per kg while, the burfi prepared with 15per cent of bottle gourd pulp in T4 was Rs. 312.48 per kg which was superiorly accepted by the panel of judges. Hence, it is concluded that best quality burfi can be prepared by using 15 per cent of bottle gourd pulp, 85 per cent of khoa with 30 per cent sugar. Addition of bottle gourd pulp could be found beneficial in the form of low calorie sweet.

Key words - Cow milk, Bottle gourd pulp, Sensory evaluation, Proximate composition, Cost Configuration

ECONOMIC STUDY OF HYBRID RICE COST AND RETURN IN DHAMTARI DISTRICT OF CHHATTISGARH STATE

DRONAK KUMAR¹, NARESH KUMAR²

DEPARTMENT OF AGRICULTURAL ECONOMICS, INDIRA GANDHI KRISHI VISHWAVIDYALAYA, RAIPUR

The farmers cultivated hybrid rice crop in 33.42% of the gross cropped area of the sample farm and respondents were classified into three groups viz., small (>2.00 hectares), medium (2.01-4.00 hectares) and large (4.01 hectares and above) farms. The total cost incurred in cultivation of hybrid Rice at the overall farm level was Rs.29249.73 per hectare which was higher in small farm (Rs.28906.90/ha) and lowest in large farm (Rs.28798/ha) revealed inverse relation with the farm size due to scale economies. The operational cost was Rs.8280, nearly 28.44 per cent of the total cost and the fixed cost was accounted for Rs.8899, around 29.61 per cent of the total cost. A glance of the shows that per hectare net income over operational cost ranged between Rs. 15714.37 to Rs. 18211.25 per hectare. The variation noted reduced in terms of family labour income due to inclusion of a relatively higher imputed value of family labour. The average per hectare family labour income was Rs. 24898.6 and was Rs. 32121 in the case of small farm, Rs. 24656.63 and Rs. 20145.38 in the case of medium and large size groups respectively. The cost of production per quintal varied from Rs. 839.44 to Rs. 903.63 with an average of Rs. 831.01.

It can be said the difference was not quite extra-ordinary between the different size classes. The hybrid rice growers on large farms is at no profit no loss position if yield level on these farms is 19.93 qt/ha which is 33.56 percent higher than actual yield.

GENOTYPIC, PHENOTYPIC AND PHYSIOLOGICAL CHARACTERIZATION OF PEARL MILLET [PENNISETUM GLAUCUM (L.) R. BR.] GERMPLASM LINES

JYOTI KAUSHIK^{1*}, DEV VART¹

¹DEPARTMENT OF GENETICS AND PLANT BREEDING, CHAUDHARY CHARAN SINGH HARYANA AGRICULTURAL UNIVERSITY, HISAR (HARYANA, INDIA) - 125004

Pearl millet is one of the most important cereals which comes at a position of fourth after rice, wheat and maize. It contains enormous genotypic and phenotypic diversity. It is a dual purpose crop which is grown for food, feed and fodder. It can yield better in those areas also where other crop even cannot survive. It is considered as an ideal species for genetic studies due to small genome size, short life cycle, protogynous nature which is helpful in hybrid seed production. As we know that yield is a complex trait and it is outcome of several component traits, like spike length, spike girth, productive tillers/plant, test weight etc. yield can be improved indirectly by improving component traits. Other than these, some physiological traits (canopy temperature depression, leaf area index, chlorophyll content) can also affect yield of a crop. Pearl millet is a highly nutritious crop. It contains macro and micro-nutrients (iron, zinc, calcium, magnesium etc). It is also known as nutri-cereal crop due to its health benefits. Pearl millet has sufficient genotypic diversity which can be assessed using SSR markers as SSRs is genome specific, evenly distributed, have high polymorphism level and easy detection. They are the marker of choice. **Keywords**: pearl millet, genotypic, phenotypic, diversity, SSR

EFFECT OF MULTITRAIT METHYLOTROPHIC INOCULANTS ON GRAIN WEIGHT, N UPTAKE AND P UPTAKE OF MUNGBEAN UNDER POT HOUSE CONDITIONS

UMANG AHLAWAT^{1*}, ANU², PRIYANKA¹ AND LEELA WATI¹

DEPARTMENT OF MICROBIOLOGY, CCS HARYANA AGRICULTURAL UNIVERSITY, HISAR (INDIA) DEPARTMENT OF GENETICS AND PLANT BREEDING, CCS HARYANA AGRICULTURAL UNIVERSITY, HISAR (INDIA)-125004

To evaluate the effect of multitrait methylotrophic inoculants on grain weight, N uptake and P uptake of mungbean under pot house conditions. Mungbean is one of most important pulse crop that is rich in protein. But during last few decades mungbean production and quality has been declined due to poor nitrogen and phosphorous availability in soil. As the chemical fertilizer like urea and single soluble phosphate may increase the quality and yield of mungbean but these are not cost effective and also harm the environment. So the alternate to this is to use the ecofriendly and cheap biofertilizers which can solubilise phosphorus and fix atmospheric nirogen. Thus aim of this experiment was to use multitrait methylotrophic biofertilizer which increases N and P uptake of mungbean plant in sustainable manner. T1 Control, T2 Rhizobium, T3 Phosphate solubilizing bacteria (P36) T4 Rhizobium + P36 T5 Methylotroph, T6 Methylotroph + Rhizobium, T7 Methylotroph + Rhizobium + P36. A total of 4 methylotrophs MP12, MP15, UP4 and PP1 were used as inoculants in pot culture treatments. The results showed that there was increase in N uptake and P uptake by plants by using multitrait methylotroph MP12 along with Rhizobia and P36 in sustainable manner.

IMPACT OF TERMINALIA ARJUNA (ROXB.) LEAF LITTER AND HOSTED TASAR SILKWORM EXCRETA ON QUALITY OF PADDY AND SOIL PROPERTIES

*R.J. MEVADA¹, DILESWAR NAYAK² AND D.P. PATEL²

¹DEPARTMENT OF SILVICULTURE AND AGROFORESTRY, ²DEPARTMENT OF NATURAL RESOURCE MANAGEMENT, ASPEE COLLEGE OF HORTICULTURE AND FORESTRY, NAVSARI AGRICULTURAL UNIVERSITY, NAVSARI – 396 450, GUJARAT, INDIA

The present investigation was carried out to assess the impact of *Terminalia arjuna* (Roxb.) leaf litter and hosted tasar silkworm excreta on quality of paddy and soil porosities *cv*. GNR 4 and laid out in nine treatments with Completely Randomized Design. The study revealed that the protein content of grain and nitrogen content of grain, straw recorded statistically higher with the application of 50% RDN through inorganic fertilizer + 50% RDN from arjuna hosted tasar silkworm excreta. However, protein yield and nitrogen uptake by grain and straw were recorded higher with the 75% RDN through inorganic fertilizer + 25% RDN from arjuna hosted tasar silkworm excreta. Further, it showed that the available nitrogen was found higher in 75% RDN through inorganic fertilizer + 25% RDN from arjuna hosted tasar silkworm excreta. Whereas, P₂O₅ were recorded higher under 100% RDN from arjuna hosted tasar silkworm excreta. Soil organic carbon and K₂O were recorded significantly maximum under the 100% RDN from leaf litter. Furthermore, soil bulk density and pH reduced, while porosity increases in 100% RDN from leaf litter. The quality of the paddy was improved under 50% RDN through inorganic fertilizer + 50% RDN through inorganic fertilizer.

CLIMATE SMART AGRICULTURE FOR SOIL AND WATER MANAGEMENT

*BHANDERI BHAVIN¹, DILESWAR NAYAK¹ D.P. PATEL¹, NILAM SURVE¹

¹DEPARTMENT OF NATURAL RESOURCE MANAGEMENT, ASPEE COLLEGE OF HORTICULTURE AND FORESTRY, NAVSARI AGRICULTURAL UNIVERSITY, NAVSARI – 396 450, GUJARAT, INDIA

Climate change is emerging major threat on agriculture food security and livelihood of millions of people of 21st century in many places of world as well as in India. According to a report, United Nation global population is projected to reach 9.7 billion by 2050. As per recent estimates, India will need to produce about 281mt food grains, 53.7mt oilseed, 22mt pulses, 127mt vegetables, and 86mt fruits by 2020-2021. To meet the food demand burgeoning population under changing climatic condition like aberrant weather, rising CO₂ level, rising

temperature, rising sea level is needed to "Climate-Smart Agriculture" (CSA) approach, which is presented in 2010 at The Hague Conference on Agriculture, Food Security and Climate Change. CSA define as "Agriculture that sustainably increases productivity enhances resilience (adaptation), reduces GHGs and enhances achievement of national food security and development goals". Many agricultural practices, soil and water management is much more important issues in CSA. Soil degradation along with soil erosion, micronutrient imbalance, poor water and nutrient use efficiency needed potential efforts for managing soil productivity same time water management also need to be improve practices like rain water harvesting and its utilization through micro-irrigation, and ground water recharge. Climate Smart Agriculture is found promising tools to mitigate climate change adverse effect on soil and water and helps to meet out the food demands for future generation by reducing the impact of climatic variability thus maintaining the proficiency and sustainability of environment.

Key words: Climate smart agriculture, environment, sustainability, management,

EVALUATION OF MICRO WATERSHEDS OF COASTAL NAVSARI **B. N. BHANDERI**

COLLEGE OF FORESTRY, ACHF, NAVSARI AGRICULTURAL UNIVERSITY, NAVSARI, INDIA

Government investments in five year plans require precise data on demand and supply of natural resources, social, economic and regional vulnerability to disasters. The assessments of the changes that have taken place in the land use pattern are needed to prepare a land use plan. The task of evaluation and planning has become easier with the advent of remote sensing and GIS. Actual field data along with remotely sensed data could help in scientific prioritization of watersheds. In this study, nine micro watersheds belonging to 5B2F1C watershed of coastal Navsari were selected to monitor their spatial and temporal changes. The study focussed on identifying the problem of each micro watershed which consequently helped in prioritizing the micro watersheds in which government investments could be made in order to initiate development work for welfare of coastal communities. The study was taken up with the objectives of characterizing, identifying major problems, assessing land use changes and prioritizing the selected watersheds. The morphological characteristics of the micro watersheds under study were identified. Stream order was found to be 3 in all the micro watersheds whereas total stream length and relief ranged from 7 km to 16 km and 9 m to 15 m respectively. Micro watershed 1C2 with ruggedness number 24.58 was found to be most prone to erosion compared to other micro watersheds. Drainage density varied from 0.84 in 1C1 to 1.62 in 1C2. The highest values of form factor, circulatory ratio and elongation ratio were 0.57, 0.85 and 0.86 in 1C1, 1C2 and 1C1 respectively. According to hydrological characterization, micro watershed 1C8 should get top priority followed by 1C4 and least priority should be given to 1C1. With respect to availability of water in form of water bodies and canal water supply, 1C3 required top priority whereas on the basis of soil and water parameters, 1C7 required top priority. 1C8 and 1C9 required top priorities based on their socio-economic condition. Keywords: GIS, Morphological characteristics, Remote sensing, Watershed.

APPLICATIONS OF REMOTE SENSING IN FOREST AND BIODIVERSITY CONSERVATION *SWATI SHEDAGE¹, P.K. SRIVASTAVA¹, DILESWAR NAYAK¹ AND NILAM SURVE¹ ¹DEPARTMENT OF NATURAL RESOURCE MANAGEMENT, ASPEE COLLEGE OF HORTICULTURE AND FORESTRY, NAVSARI AGRICULTURAL UNIVERSITY, NAVSARI - 396 450, GUJARAT, INDIA

The forest cover at the national level is being biennially monitored using remote sensing data and it is estimated that India has 24.49% of forest cover out of the total expected 33% of forest cover as per India's forest policy. Remote sensing techniques have proved to be powerful tool for the monitoring of various referred environmental features, such as vegetation cover, soil erosion, as well as urban expansion and more generally, the variations in the LULC over a period of time. Satellite-derived vegetation map and various landscape ecological parameters have been analyzed to characterize various habitat ecosystems. The part of the electro-magnetic spectrum that is most widely used in remote sensing extends from the visible wavelengths, through progressively longer wavelengths, to the microwave and radio wavelengths used by radar systems. The limited ranges of human vision and conventional photography are apparent. Many features, particularly vegetation and water, show unique variations in the infra-red parts of the electro-magnetic spectrum. Thermal infra-red can be used to detect areas with high rates of evaporation or evapo-transpiration, due to their lower temperatures relative to their surroundings, as well as zones of thermal pollution in water, which could be caused by chemicals or hot water discharges from power stations. Finally, at wavelengths of millimetres to metres, the microwave or radio pulses utilised by radar systems are particularly useful for mapping soil moisture contents and areas of inundation, with the added advantage of being able to see through cloud cover. Radar systems are particularly effecting at measuring surface roughness and thereby mapping the texture and shape of features on the surface of the Earth. Further, satellite data have become a major application in change detection because of the repetitive coverage of the satellites at short intervals. Remote sensing and geospatial technologies find tremendous application in rapid spatial and temporal monitoring as well as assessment of forest and biodiversity resources and hence in formulation of concrete policy frameworks for their sustainable management. Keywords: Remote Sensing, Forest, Biodiversity, Radar, GIS.

AFGROFORESTRY MODELS OF SOUTH GUJARAT ¹MANMOHAN J. DOBRIYAL* AND MOHIT HUSAIN² ¹DEPARTMENT OF SILVICULTURE AND AGROFORESTRY, RLCAU, JHANSI-284 003, UTTAR PRADESH ²DEPARTMENT OF SILVICULTURE AND AGROFORESTRY, ASPEE COLLEGE OF HORTICULTURE AND FORESTRY, NAVSARI AGRICULTURAL UNIVERSITY, NAVSARI – 396 450, GUJARAT, INDIA

South Gujarat has seven districts namely Suart, Bharauch, Navsari, Dang, Valsad, Narmada and Tapi. This review paper based on survey shows that most of the farmers of these regions are growing mainly Horti-silvi (HS), Agri-silvi-horticulture (ASH), Agri-silviculture (ASH), Agri-horticulture (AH), Homegardens (HG) and Horti-pasture (HP) systems at their fields. Farmers of these regions are mainly adopting Horti-silviculture system as teak main tree components on boundary with sapota or mango as main crops. Some farmers also adopting teak based paddy agroforestry systems (Agri-Silviculture system). These exiting agroforestry systems provide more return per unit area as compare to other existing agroforestry practices in these regions and also require less amount of irrigation water. These two systems are mainly based on rain water and this is the reason that why these regions farmers adopting these two systems. Keywords: South Gujarat, Agroforestry systems, farmers, production.

ROLE OF GREEN MANURING IN ORGANIC FARMING

*SHUBHAM MAURYA¹, ANISH KUMAR PATEL², KUWAR YESHVIR ARYA³, RAM VEER⁴ AND ZIOM ADAM MICHAL⁵ DEPARTMENT OF SOIL SCIENCE & AGRICULTURAL CHEMISTRY, INSTITUTE OF AGRICULTURAL SCIENCES BANARAS HINDU UNIVERSITY VARANASI UTTRA PRADESH, INDIA 221005

Green manures, also referred to as fertility building crops, may be broadly defined as crops grown for the benefit of the soil. Soil health degradation is one of the most important problem faced by farmer. Due to land is becoming barren. This practice is increasing in recent years because high cost and uncontrolled use of chemical fertilizer, increased risk of environmental pollution and the negative impact on human health and need of sustainable cropping systems. The organic farming depends on organic manure farm yard manure, compost green manure. Green manuring can improve soil physical ,chemical and biological properties and consequently crop yield .It improve humus ,organic carbon ,nitrogen and soil microbial growth and it can bring a number of advantages to the grower .They help to increase the supply of nutrients available to plants, addition of organic matter to the soil , improve soil structure , increase biological activities in the soil ,reducing soil erosion. We purpose that future research efforts make improved use for whole systems and participatory strategies to better for green manuring cropping systems and the obstacles preventing farmer adoption of GM approaches. **Keywords**: Green manures, soil fertility, organic farming.

VERTICAL FARMING-GROW FOOD EVERYWHERE

ZIOM ADAM MICHAEL* AND RAMAWATAR MEENA DEPARTMENT OF SOIL SCIENCE AND AGRICULTURAL CHEMISTRY, BANARAS HINDU UNIVERSITY, VARANASI-221005, INDIA

Many have wondered for years if vertical farming is really the answer to the shortage of food in the world. The concept of vertical farming might seem to many startups, it is an ingenious method to produce food in environments where arable land is unavailable or rare. Vertical Farming is a revolutionary and more sustainable method of agriculture. Thisis an innovation in the field of agriculture with sustainability as its motto is making more and more heads turn today with its eco-friendly methods and making the possibility of farming real in difficult environs. It is a theoretical concept that may offer panacea to our food production problem in the future. Vertical farming includes hydroponics, aeroponics, aquaponics, local aero farms-smart vertical farming innovations, plant scrapers, Verti crop, modular farms, cubic farming systems-the next generation sustainable farming system, zip grow, bowery-the most technologically sophisticated commercial indoor farm, sky farm-wind powered, sky greens-first hydraulic farm. Vertical farms could enable every country in the world regardless of climate or agricultural land to be able to grow food in an efficient manner. They could save energy, water, reduce toxins, provide new employment opportunities, restore ecosystems and much more. It is believed that farming has been blight on the natural land scape for 1,20,000 years and that buy producing food in vertical farms, it will allow us for the first time to feed everyone on the earth and still return land to its original ecological condition. By the time 2050 rolls around 80% of the total world's population will dwell in an urban setting. With more and more people focused on healthyorganic food bought locally, the demand is even greater to bring food production closer to city. It doesn't eliminate traditional rural farming but merely to reduce the strain put on the land. **Keywords**: Environs, hydroponics, aeroponics, aquaponics.

FOREST ECOSYSTEM: AS A COMPLEX ECOSYSTEM FOR LIFE

*BHURA CHAUDHARY¹ AND MOHIT HUSAIN²

¹CAAST, NAVSARI AGRICULTURAL UNIVERSITY, NAVSARI – 396 450, GUJARAT, INDIA ²SRF, DEPARTMENT OF SILVICULTURE AND AGROFORESTRY, ASPEE COLLEGE OF HORTICULTURE AND FORESTRY, NAVSARI AGRICULTURAL UNIVERSITY, NAVSARI – 396 450, GUJARAT, INDIA

The common impression for many people is that forests are just collection of trees. However, they are much more than that. They are a complex, functional systems of interacting and often interdependent biological, physical and chemical components the biological part of which has evolved to perpetuate itself. This complexity produces combinations of climate, soils, trees and plant species unique to each site, resulting in hundreds of different forest types around the world. A forest ecosystem is not just about the forest environment, however. It is also about the animals that live in the forest. For example, birds nest in the trees of a forest, members of the fungus kingdom grow on the forest floor and a variety of insects and mammals also take up their homes in a forest. An ecosystem is a biological community of interacting organisms ecosystem is a terrestrial unit of living organisms and their physical environment. A forest ecosystem is a terrestrial unit of living organisms), all interacting among themselves and with the environment (soil, climate, water and light) in which they live. The forest is one of the main resources in our world. Nearly it occupies 40% of the world's land area. In India 24.49% of the land is occupied by the forest and tree cover. An ecosystem is a region with a specific landscape form such as forests, grasslands, deserts, wetlands or coastal areas. The nature of an ecosystem is based on geographical features such as hill, mountains, plains, rivers, lakes and coastal areas. It is controlled by climate condition such as the amount of sunlight, the temperature and the rainfall in the region. Types of ecosystems are natural (terrestrial and aquatic) and artificial ecosystems. Factors of an ecosystem are abiotic factors and biotic or living factors.

Keywords: Forest, Environment, Ecosystems, Organisms.

EFFICIENCY OF SPRYING OVER DUSTING IN AGRICULTURE

NARENDRA KUMAR YADAV

M. TECH. RESEARCH SCHOLAR (FMPE), CTAE, MPUAT, UDAIPUR-RAJASTHAN.

Chemicals are extensively used for controlling disease, insects and weeds in the agricultural crops as well as forest crops. They are able to save a crop from the attack of pest only when applied in time. They need to be applied on plants and soil in the form of spray and dust or mist. The chemicals are costly and environmentally hazardous. Therefore, equipment for uniform and effective application is essential for

efficient use of required chemical to crops. Dusters and sprayers are generally used for applying chemicals. Dusting, the simpler method of applying chemical, is best suited to portable machinery and it usually requires simple equipment. But it is less efficient than spraying, because of the low retention of the dust. High volume spraying is usually effective and reliable but is expensive. Low volume spraying to some extent overcomes the failings of each of the above two methods while retaining the good points of both. Therefore farmers are most commonly using spray technology to control the insect and pest attack at their fields.

Keywords: Spray, dusting, insect-pest, crops, efficiency.

GROWTH PERFORMANCE OF AND METAL ACCUMULATION BY LINUM USITATISSIMUM L. GROWN ON CHROMIUM AND NICKEL AMENDED SOIL ASHYANA KOUSER AND ATHAR ALI KHAN

ENVIRONMENTAL BOTANY LABORATORY, DEPARTMENT OF BOTANY, ALIGARH MUSLIM UNIVERSITY, ALIGARH-202002 (U.P.), INDIA.

Excessive use of heavy metals in the agricultural sector (Pesticides, fungicides, and fertilizers) and multiple sectors create ecotoxicity in the aquatic and terrestrial ecosystems and affects the development of all living organisms. Flax (Linum usitatissimum L. vernacular Alsi) belongs to the family Linaceae and is mostly grown in cooler regions of the world. Flax fibres are used for manufacture of fine linen fabric. Linseed oil is reported to possess anti-inflammatory, analgesic and antipyretic properties. Flax seeds, when administered orally, in combination with sesame (Sesamum indicum L.) seeds are supposed to act as an aphrodisiac. Lightly roasted seeds are administered as a general tonic. Therefore, these seeds find extensive use in ethno-medicine and modern medicine both. Being a drying oil, it is also used in manufacture of paints and wood finishing products. Chromium (Cr) and Nickel (Ni) are common soil contaminants in arable lands causing eco-toxicity and ecological shift. Flax plants were grown in garden soil amended with different levels of Chromium and nickel chlorides under ambient environmental conditions. Data were gathered on growth parameters (plant height, dry weight, number of leaves, number of flowers and number of seeds etc.), biochemical parameters (Chlorophyll pigments, antioxidant activity and proline content), and metal accumulation. Phytotoxicity of these metals was directly proportional to the metal level in soil. All parameters except the proline content and anti-oxidant activities showed progressive reduction. To minimise the loss as an initial adaptive strategy leaf fall, reduced branching and early flowering were induced in heavy metal dose dependent manner. Treatment of test plants with different concentrations of heavy metals (mg/kg of soil) had shown maximum accumulation of Cr followed by Ni in root, shoot, leaves and seeds. However, phytotoxicity induced by these heavy metals were in order of Ni> Cr. Seeds obtained from metal treated plants contained low (4.67 µg/g Cr and 1.33 $\mu g/g$ Ni) quantities of chromium and nickel and their long-term consumption may cause the metals to accumulate in body tissues to toxic level. It is, therefore, advisable to refrain from consuming the flax seeds harvested from chromium and nickel affected areas. Keywords: Chromium, Flax, Nickel, Phytotoxicity.

NATURAL RESOURCE MANAGEMENT AND THEIR CONSERVATION

¹NILAM SURVE^{*} AND ¹BHANDERI BHAVIN

¹DEPARTMENT OF NATURAL RESOURCE MANAGEMENT, ASPEE COLLEGE OF HORTICULTURE AND FORESTRY. NAVSARI AGRICULTURAL UNIVERSITY, NAVSARI - 396 450, GUJARAT, INDIA

Conservation of natural resources was felt by our predecessors, there was a tradition of respecting and preserving the nature and natural resources. Natural resources were conserved in the form of sacred groves/forests, sacred pools and lakes and sacred species etc. In our country the conservation of natural forests is known from the time of Lord Ashoka. Sacred forests are forest patches of different dimensions dedicated by the tribal to their deities and ancestral spirits. Cutting down trees, hunting and other human interferences were strictly prohibited in these forests. This practice is wide spread particularly in peninsular, central and eastern India and has resulted in the protection of a large number of plants and animals and. Similarly, several water bodies, e.g., Khecheopalri lake in Sikkim was declared sacred by people, thus, protecting aquatic flora and fauna. Worshipping certain plants like banyan, peepal, tulsi etc. has not only preserved them but also encouraged us for their plantation. History recalls numerous instances where people have laid down their lives in protecting the trees. Recent Chipko movement in India is one of the best examples. Natural resources are being over exploitation by the growing population so their conservation and management are necessary for sustaining.

Key words: Natural resources, conservation, sacred groves, protection.

CLIMATE CHANGE, ITS IMPACT ON AGRICULTURE AND MITIGATION STRATEGIES

NIKUNJ JOSHI¹, HASMUKH LEUA², CHIRAG THAKAR³ DEPARTMENT OF FRUIT SCIENCE, COLLEGE OF HORTICULTURE, SARDARKRUSHINAGAR DANTIWADA AGRICULTURAL UNIVERSITY, JAGUDAN - 384460, GUJARAT

Population growth and climate change are the challenges of the 21st Century. Climate change is mainly caused by anthropogenic emissions of greenhouse gases (GHG: CO₂, CH₄, N₂O, HFC, PFC and SF₆), which accumulate in the earth's atmosphere and trap heat. It is a known fact that global temperature levels will rise anywhere between 2 - 5° over the next century. In developing countries like India, climate change could represent an additional stress on ecological and socio-economic systems that are already facing tremendous pressures due to rapid urbanization, industrialization and economic development. Climate change has had an effect on the monsoons too. India is heavily dependent on the monsoon to meet its agricultural and water needs, and also for protecting and propagating its rich biodiversity. Most of the simulation studies have shown a decreased in the duration and yield of crops as temperature increased in different parts of the India. Yields of both *kharif* and *rabi* crops decreased as temperature increased by 2°C; and increase resulted in 15-17 percent decrease in the grain yield of both crops, but beyond that the decrease was very high in wheat.. The nutritional quality of cereals and pulses may also be moderately affected which in turn will have consequences for our nutritional security. The loss in farm level net revenue may range between 9 per cent and 25 per cent for a temperature rise of 2-3.5°C climate change. The potential of organic agriculture in mitigating climate change depends on its ability to reduce emissions of GHGs, nitrous oxide and methane, increase soil carbon sequestration, and enhance effects of organic farming practices which favor the above two processes. Reduction of greenhouse gas emissions recent

experiments results suggested that organic agriculture can significantly reduce GHG emissions. Both conventional and organic agriculture relies on solar and fossil energy for food production. Carbon sequestration in soils and plants is the only strategy that can remove carbon from the atmosphere and, over time, reduce atmospheric concentration of CO₂. This approach allows the enforcement of adopting new and improved farming practices aim at mitigating climate change. In addition, organic agriculture is highly adaptable to climate change and is also provides a high degree of diversity in the ecosystem.

BRIDGING THE DIGITAL DIVIDE AND DELIBERATIONS ON, E-NAM, E-MANDI

NARESH KUMAR¹, DHIRENDRA KUMAR²

DEPARTMENT OF AGRICULTURAL ECONOMICS, INDIRA GANDHI KRISHI VISHWAVIDYALAYA, RAIPUR

The respective Agricultural Produce Marketing Committees (APMCs) will need to implement the tenets of the envisaged NAM in a phased manner, including enabling infrastructure for integrating pre- and post-auctioning activities. The proposed NAM framework envisages real-time electronic auctioning of the commodities along with integrated assaying, weighing, and storage and payment systems. It proposes to issue a single license for trading across the country in order to promote increased participation. On the eNAM platform, farmers can opt to trade directly on their own through the mobile app or through registered commission agents. The eNAM is linked with 585 markets (APMCs) in 16 states and 2 union territory, with over 45 lakh farmer membership in 15 states. The market is helping traders and exporters in procuring quality products in bulk, at one place and ensure transparent financial transactions. The Government plans to connect over 22,000 Grams, local farmers markets, with the platform. To provide better grading and assaying services, the Agriculture Department is looking at looping in AGMARK for better certification. The trading is done online, with trading computers or through the mobile app in all eNAM markets. **Mobile App**-An eNAM mobile application is available on android for farmers and traders to bid and complete a transact on the app, available in 8 languages. **Payment**-The payment network RTGS/NEFT, debit card and internet banking was also integrated into the app. In 2017 mobile payment, United Payment Interface (UPI) facility through BHIM support was added in the app. **Gate entry**-The mobile phone gate entry, integration of farmer's database and e-learning module is available. The agents are mostly using the eNAM mobile App for trading on behalf of farmers.

SOIL AND WATER CONSERVATION IN INDIA-AN OVERVIEW

NEHA¹ AND GAJENDER²

¹CHAUDHARY CHARAN SINGH HARYANA AGRICULTURAL UNIVERSITY, HISAR, HARYANA-125004 ²ICAR- CENTRAL SOIL SALINITY RESEARCH INSTITUTE, KARNAL, HARYANA-132001

Soil and water are the most important natural resources that meet all human needs and safeguard the environment and the civilization. Land degradation is a serious problem in India and out of 329 million hectare (Mha) of total geographical area, 146.8 Mha is reported as degraded. India is losing a huge amount of money in terms of loss of productivity from these degraded lands. Though India receives good amount of annual rainfall (1190 mm) but with the economic expansion and increasing population of the world especially in developing countries, the influence on environment, particularly soil and water, by anthropogenic activities is ineluctably exacerbating. The inadvertent unawareness of protection and conservation of these resources during the economic growth in past several decades has severely led to increasing water shortage and water pollution besides soil deterioration. We found that to achieve success in soil and water conservation policies, institutions and operations must be coordinated using a holistic approach. Watershed programmes are one of the most effective strategies for bringing socio-economic change to different parts of India. Annual erosion rate due to water is less than 5 Mg/ha/yr (2.2 tons/acre) for dense forest (above 40% canopy), cold desert regions, and arid regions of India. Wind erosion is also active in the Indian desert situated in the north western part of the country. Indo-Gangetic plains, including salt-affected lands of Punjab, Haryana, Uttar Pradesh, Bihar and West Bengal show moderate erosion rates (5-10 Mg/ha/yr). The areas revealing severe erosion are in north western Himalayan regions, shifting cultivation regions, ravines, western coastal Ghats and the black cotton soils of Peninsular India. Significant results associated with various watershed-scale soil and water conservation programmes and interventions that were effective for reducing land degradation and improving productivity in different parts of the country. Soil conservation practices include soil management, crop management, engineering, range management and forestry operation.

Keywords: Soil and water conservation, degraded lands, watershed, range management

FLY ASH AND BAGASSE ASH : AS A NOVEL REPLACEMENT OF POTASSIC FERTILIZER WITH ADVANCEMENT IN SOIL HEATH AND CROP QUALITY

SHUBHAM A. DURGUDE

GBPUA&T PANTNAGAR, UTTARAKHAND, INDIA 263145

A field experiment was conducted during the year 2016-17 at the Post Graduate Institute Research Farm, Mahatma Phule Krishi Vidyapeeth, Rahuri, The experiment was laid out in randomised block design with three replications and ten treatments. Which comprised of T₁: Absolute control, T₂ : General recommended dose of nutrients where K₂O through muriate of potash, T₅ to T₆ were general recommended dose of N and P and 125, 100, 75 and 50 % K₂O through fly ash, respectively and T₇ to T₁₀ were general recommended dose of N and P and 125, 100, 75 and 50 % K₂O through bagasse ash respectively. The result of the experiment revealed that the application of RDF of nitrogen and phosphorous along with replacement of muriate of potash with graded levels of fly ash and bagasse ash in treatment T₃ to T₆ and treatment T₇ to T₁₀ respectively with 10 t ha⁻¹ of FYM, gave significantly higher grain and straw yield of wheat especially significantly increased (42.92 and 53.88 q ha⁻¹, respectively) in treatment of application of 125 % K₂O through bagasse ash along with recommended dose of N and P₂O₅ through chemical fertilizer + 10 t ha⁻¹ FYM (T₇). Application of various levels of K₂O through fly ash in soil noticed negative effect on physical properties of soil *viz.*, increased in bulk density, COLE value and decreased in hydraulic conductivity of soil. Application of various levels of K₂O through fly ash and bagasse ash in soil did not shows differences in available nitrogen in soil at all the growth stages, but slight improvement was found to be significantly observed in availability of P and K in soil at crown root initiation and harvest stage due to application of bagasse ash as compared to fly ash treatment over GRDF and control treatments. Similar trend of increased in availability of DTPA-Fe, Mn, Zn and Cu in soil at CRI and harvest stages

observed in application of bagasse ash as source of K₂O as compared to fly ash treatments. The higher DHA and bacterial population was observed in both the treatments of application of 125 % K₂O through bagasse ash at crown root initiation and harvest stage. The highest total chlorophyll content, N, P, K, Fe, Mn, Zn and Cu uptake in wheat crop and agronomic efficiency were also observed to be highest in treatment of application of 50 kg ha⁻¹ K₂O through bagasse ash along with recommended dose of N and P₂O₅ through chemical fertilizer + 10 t ha⁻¹ FYM (T₇). In case of the wheat quality parameters, highest test weight was found in treatment of application of 125 % K₂O through bagasse ash along with recommended dose of N and P₂O₅ through chemical fertilizer + 10 t ha⁻¹ FYM (T₇), however, slightly improvement in quality parameter like crude protein and gluten contents were observed in application of bagasse ash as compared to fly ash even statistical results obtained non significant. The higher net monetary returns (Rs. 41406/- and Rs. 39028/-) were recorded in treatments of application of bagasse ash @ 13.02 and 10.41 q ha⁻¹, respectively in soil for the supplementation of K₂O @ 50 and 40 kg ha⁻¹, respectively. The same trend was also observed in benefit : cost ratio which was found higher in treatments of T₇ (1.86) followed by T₈ (1.81). It can be concluded that, the application of 125 % K₂O through bagasse ash @ 13.02 q ha⁻¹ along with recommended dose of N (120 kg ha⁻¹) and P₂O₅ (60 kg ha⁻¹) through chemical fertilizer + 10 t ha⁻¹ FYM to wheat crop at the time of sowing was found beneficial for increase in nutrient uptake, improvement in biological properties of soil, higher net monetary returns , B:C ratio (1.86) and yield of wheat grown in an Inceptisol. This study revealed that , bagasse ash can be an alternative source of potassium which will save the foreign exchange on K fertilizers in future.

RESIDUAL EFFECT OF APPLIED VERMICOMPOST AND NPK TO RICE ON GROWTH AND YIELD OF SUCCEEDING WHEAT AND CHEMICAL PROPERTIES OF SOIL

AMIT KUMAR1, B.P. DHYANI1, ASHISH RAI*2 AND VIPIN KUMAR2

1DEPARTMENT OF SOIL SCIENCE, SARDAR VALLABHBHAI PATEL UNIVERSITY OF AGRICULTURE & TECHNOLOGY, MEERUT, UTTAR PRADESH-INDIA

2DEPARTMENT OF SOIL SCIENCE AND AGRICULTURAL CHEMISTRY, INSTITUTE OF AGRICULTURAL SCIENCES, BANARAS HINDU UNIVERSITY, VARANASI, UTTAR PRADESH-INDIA

Two consecutive field experiments after rice crop were conducted during 2011-12 and 2012-13 in the Crop Research Centre, of Sardar Vallabhbhai Patel University of Agriculture and Technology, Uttar Pradesh. Ten different treatments were implied to evaluate the residual effect of vermicompost and applied inorganic fertilizers on wheat crop. Significantly taller plants than T2 during both the years were measured in those treatments where 4 ton vermicompost was applied in rice. Spike length and test weight of wheat remained unaffected due to residual effect while the number of grains per spike was significantly affected. Grain yield varied from 20.00 to 48.70 and 21.30 to 49.50 q ha-1 during 2011-12 and 2012-13, respectively while straw yield 36.35 to 71.24 and 39.53 to 73.04 q ha-1 during 2011-12 and 2012-13, The maximum grain yield 48.70 and 49.50 q ha-1 during 2011-12 and 2012-13, respectively and straw yield 71.24 and 73.04 q ha-1 was recorded in T10 where along with 50% N, 100% P and K 4 ton vermicompost was applied in rice at flowering and 100% NPK to wheat. Residual effect of 4 ton vermicompost application on available soil K was significant. Organic carbon (%), pH and electrical conductivity (dSm-1) were not significant. **Keywords**: Residual effect, vermicompost, yield attributes, grain yield, straw yield and chemical properties of soil

METHANE PRODUCTION BY ANAEROBIC DIGESTION OF SEWAGE RENU AGARWAL,

I.N.P.G. COLLEGE, MEERUT

Anaerobic digestion is an established technology for the treatment of sewage. This is source of Marsh gas methane as discovered by Alessandro volta in 1776. The digestion process begins with bacterial hydrolysis of the input materials. Insoluble organic polymers, such as carbohydrates are broken down to soluble derivatives Acidogenic bacteria then convert the sugars and amino acids into carbondioxide, hydrogen, ammonia and organic acids. Anaerobic digestion is widely used as a source of renewable energy. The process produces a sulphate biogas, consisting of methane, carbon dioxide, hydrogen etc. The biogas can be used directly as fuel. The four key stages of anaerobic digestion involve hydroysis, acido gensis acetogenesis methanogenesis. Anaerobic digestion can be using a number of different configuration and can be categorized into mesophillic vs thermophilic temperature. After separating out carbon dioxide and hydrogen sulphate bychemical process the methane (transformed into biomethane) can be used as vehicle fuel in adopted vehicles. This use is very extensive in sweden. Where over 36.600 gas vehicles exist, and 60% of the vehicle gas is biomethane generated at anaerobic digestion plants.

EFFECT OF GAMETOPHYTIC SELECTION ON YIELD PARAMETERS IN A POLLEN POPULATION OF MAIZE (ZEA MAYS L.)

UPASANA MOHAPATRA^{1*}, R. L. RAVIKUMAR¹, JYOTI P JIRANKALI²

¹DEPARTMENT OF PLANT BIOTECHNOLOGY, UNIVERSITY OF AGRICULTURAL SCIENCES, GKVK, BENGALURU ²DEPARTMENT OF GENETICS AND PLANT BREEDING, UNIVERSITY OF AGRICULTURAL SCIENCES, GKVK, BENGALURU

The effect of gametophytic selection for heat tolerance in pollen population produced by F_1 plants on the performance of F_2 generation plants in maize was studied. One set of F_1 plants produced by crossing BTM14 (heat susceptible) and BTM6 (heat tolerant) parents were selfed using pollen grains exposed to 36 °C for 3 hours in the laboratory to produce seeds of selected F_2 . Another set of F_1 plants were selfed without pollen selection producing seeds of control F_2 . The control and selected F_2 populations were grown during Kharif 2017 at GKVK, Bangalore. The selected F_2 population showed vigorous growth with significantly higher mean seed yield per plant (59.53 g) compared to control F_2 population. The selected F_2 population also recorded significantly higher mean cob diameter (2.29 cm), cob length (14.76 cm) and number of seeds per row (23.76). The KS test suggested that the selected F_2 population had significantly more number of plants having higher number of seeds per row, cob diameter, cob length and seed yield per plant compared to control F_2 population. These results clearly evidence that the gametophytic selection for heat tolerance in F_1 generation had positive effect on the performance of F_2 for seed yield and yield related traits in maize.

Key words: Gametophytic selection, Heat tolerance, Pollen population.

BIOCHEMICAL ANALYSIS OF BUCKWHEAT (*FAGOPYRUM ESCULENTUM* MOENCH) GENOTYPES FOR QUALITY PARAMETERS

K. C. VERMA

LOVELY PROFESSIONAL UNIVERSITY, PHAGWARA(PUNJAB)-144401, INDIA

PRESENT ADDRESS: DEPARTMENT OF BIOCHEMISTRY, GOVIND BALLABH PANT UNI. OF AGRIL. & TECH., PANTNAGAR(U. S. NAGAR)-263145, UTTARAKHAND, INDIA

Faced with acute problem of protein energy malnutrition in the vast prevailing, vulnerable population of our country, the content and quality of pseudocereal proteins become a pertinent point of consideration. Buckwheat (*Fagopyrum esculentum*), one of the traditional, underexploited crop having food value, can be grown in harsh climatic condition requires low input and is well adapted to environmentally compatible agriculture. In the present study, fourteen genotypes of buckwheat were assessed for their nutritional value. 1000 seed weight was varied from 9.48 gms -15.22 gms. Buckwheat biotypes contains high amount of protein (7.69-15.47 %). Rutin, the most important ingredient of buckwheat was also varies (3.74-6.53%) in different biotypes. It was also found that many essential amino acids are also found in buckwheat. Variations among almost all estimated parameters were found to be highly significant. Thus, buckwheat with higher nutritional value, antioxidant potential and a number of other health benefits is comparable to and even sometimes better than other popular crops and provide benefits beyond nutrition because of the presence of its phyto-active constituents. It can be exploited in nutraceutical and pharmaceutical industries as well.

Keywords: Buckwheat, Protein, Rutin

MALE APHRODISIC AND FEMALE ANTIFERTILITY SCREENINGOF PLANTS MUCUNA PRURITA, MESUA FERREA, PUNICA GRANATUM ON RATS

SONU SHARMA

DEPARTMENT OF PHARMACOGNOSY, FACULTY OF PHARMACY, SCHOOL OF PHARMACEUTICAL SCIENCES, JAGATPURA, JAIPUR

Combined extract of these plants showed significant increase in uterine weight in a dose-dependent manner compared to vehicle control. The estrogenic effect of Combined extract with reference standard Ethinyl estradiol (0.02 mg kg-1, p.o., the ethanolicCombinedextract at 200 mg kg-1 offered more potent estrogenic activity than the reference standard. The extract significantly increased the weights of uteri and showed synergistic effectas increase in the height of luminal epithelium and loose and edematous stroma with stimulated uterine glands. It concluded that Herbal Plants Mucunaprurita, Mesuaferrea, Punicagranatum have Synergistic Effect on Reproductive Functions in male and female both.

Key words :Investigation , Sildenafil Citrate, Ethinyl Estradiol, Synergistic

ANTIDIABETIC AND NEPHROPROTECTIVE EFFECT OF AJUGA BRACTEOSA LEAVES IN ALLOXAN INDUCED DIABETIC CHICKS

REKHA BISHT¹, DHARMENDRA KUMAR^{1*}

¹DEPARTMENT OF ZOOLOGY, S. V. GOVT. P. G. COLLEGE LOHAGHAT, (CHAMPAWAT), UTTARAKHAND

Present study was based on a local medicinal plant; *Ajuga bracteosa* (Ratpatiya) which has antidiabetic and antioxidant property clinically or preclinically. In our study the antidiabetic property of *Ajuga bracteosa* was checked in alloxan induced diabetic chicks. Alloxan (12 mg/ 100 gm body weight, i.p.) was used to induce diabetes in chicks and the blood glucose levels were estimated by using commercial kit (Span Biotech, Surat, India). After the confirmation of diabetes in chicks, hydroalcoholic extract of leaves of *Ajuga bracteosa* (10 mg/ 100gm body weight, orally) was administered to the diabetic chicks for 30 days daily. The study was carried out by monitoring the blood glucose level and creatinine level for kidney function assessment in experimental chicks. The administration of hydroalcoholic extract of *Ajuga bracteosa* in diabetic chicks showed a marked decline in the blood glucose level and creatinine level in comparison to the diabetic control chicks (p<0.05) and is almost or near to the values in Normal control chicks (p<0.05). These results suggest that the extract of *Ajuga bracteosa* leaves have potent antidiabetic and nephroprotective property against alloxan induced diabetic chicks. **Keywords**: Alloxan, antidiabetic, *Ajuga bracteosa*, nephroprotective.

SMART IRRIGATION SYSTEM DESIGN WITH SOLAR SYSTEM USING PID CONTROLLER

ANCHAL YADAV AND PRATIBHA TIWARI

DEPARTMENT OF ELECTRICAL ENGINEERING, VAUGH INSTITUTE OF AGRICULTURAL ENGINEERING AND TECHNOLOGY, SAM HIGGINBOTTOM UNIVERSITY OF AGRICULTURE, TECHNOLOGY & SCIENCES ALLAHABAD 211007, U.P., INDIA

In this paper, minimize the human interface for the agriculture sector, which gives relief to the former for performs automatic irrigation operation through monitoring. Using a combination of software, this integrated a microcontroller which is Arduino, four real-time sensors fetching input data from field and a DC motor pump as output are used. Proportional Integral and Derivative (PID) work as integrated controller into Arduino. The input involves four sensors for ambient temperature, humidity, and radiation sensors, wind speed which gives soil moisture as the reference point. PID controller work based on the ratio of four different sensors and penman model of evapotranspiration. The system connected with solar panel which is recharged by grids of solar through a lead-acid battery. Measure the field conditions by four designated sensors and simultaneously send information through wireless communication to a remote placed monitoring device which has a Liquid Crystal Display (LCD).

Keywords: Proportional Integral and Derivative (PID), Solar Panel, Penman Model of Evapotranspiration, Arduino, Irrigation System, Lead Acid Battery, Moisture sensor.

MICROPROPAGATION OF CODONOPSIS CLEMATIDEA- A POTENTIAL TECHNIQUE TO EXTRACT PHYTOCHEMICALS

ANKITA SHARMA^{#*}, PUSHPENDER BHARDWAJ[#], SHARDULYA SHUKLA, PRITAM KAUR, SHWETA SAXENA MEDICINAL PLANT DIVISION, DEFENCE INSTITUTE OF HIGH ALTITUDE RESEARCH C/O 56 APO, INDIA

The Indian trans-Himalayan region, spanning over 186,000 km² area above natural tree line forms a major portion of 'The Great Himalayas', one of largest and juvenile mountain range in the world. The Himalayan and trans-Himalayan flora is well recognized as a source of medicines in traditional medicinal systems *viz.*, Ayurvedic, Unani, Siddha, Tibetan and other non-formal traditional systems of medicine since time immemorial. *Codonopsis clematidea* is a medicinal plant of Leh-Ladakh region, used in traditional 'Amchi' system. Present study aims to investigate the role of assorted plant growth regulators on *in vitro* propagation, followed by comparative estimation of antioxidant potential and luteolin content in leaves of *in-vitro* and wild plants. Nodal part of seedlings grown on MS basal medium supplemented with 0.7% activated charcoal was used as source of explants. Different concentrations of BAP and NAA were tested for multiple shoot regeneration. Antioxidant activity was estimated using DPPH and FRAP methods whereas Luteolin was estimated using HPLC. MS basal medium supplemented with 0.5 µM NAA and 2.0 µM BAP producing optimum no of shoots (2.33±0.33) of optimum length (3.7±0.06 cm) after 21 days was selected for multiplication of shoots. Total phenolic and flavonoid content of 0.33±0.05 and 62.77±2.88 µM of RE/g of DPE was obtained in the leaves of MEM and MEW respectively. IC₅₀ value for DPPH radical scavenging capacity of MEM was 3.66 mg/mL in comparison to MEW (12.98±0.11 mg/g). This is the first report of *in vitro* propagation of *Codonopsis clematidea*. Further, for the first time comparative phytochemical evaluation of luteolin has been reported. **Keywords**: Micropropagation, Leh-Ladakh, *Codonopsis clematidea*, Luteolin

REMOTE SENSING AND GIS APPLICATION IN AGRICULTURE FIELD AND NATURAL RESOURCE MANAGEMENT UNDER CHANGING CLIMATE

*ANUNAY KUMAR¹ AND ANUSHKA SHARAN²

1-2 DEPARTMENT OF AGRONOMY, INSTITUTE OF AGRICULTURAL SCIENCES, BHU VARANASI-UTTAR PRADESH

Agricultural production and natural resource production system are highly vulnerable to variation in climate, soil and topography of different regions. Increasing food needs of growing population demand the efficient use of natural resource in comprehensive manner. Remote Sensing and Geographical Information System (GIS) offer an abundant opportunity to monitor and manage natural resources and agriculture field at multi-spectral and multi-spatial resolution. Agricultural has remained essential activity of nation in production of food in sufficient quantity and quality for the well being of the people. Spatial information on agricultural practices is crucial for agricultural planning. Timely and reliable information on agricultural basis to be beneficial to producers, managers and policy planners for taking decision for security of food and import/export and economic impact. Certain agencies in India is involved in monitoring of land utilization/cropping pattern at national or state level. The data collected from remote sensing are organized in GIS help in analysis and about crop and agricultural strategies. The integrated use of remotely sensed data GPS, GIS, enable consultants and natural resource managers and researchers in government agencies, conservational organizations, and industry to develop management plans. An attempt made in present study to analysis and evaluate the information regarding the application of remote sensing techniques for crop monitoring, crop condition assessment and yield estimation for sustainability of agricultural and natural resources under changing climatic scenarios. Remote sensing data can provide timely, synoptic, cost efficient and repetitive information about the earth's surfaces. **Key words:** Remote sensing, climate change, yield assessment, GIS.

EVALUATION OF RICE GENOTYPES WITH SPECIAL EMPHASIS ON IRON AND ZINC CONTENT

MAINI BHATTACHARJEE ¹*, KASTURI MAJUMDER², SABYASACHI KUNDAGRAMI³ AND TAPASH DASGUPTA⁴ ^{1,2,3}DEPARTMENT OF GENETICS AND PLANT BREEDING, INSTITUTE OF AGRICULTURAL SCIENCE, UNIVERSITY OF CALCUTTA, 51/2 HAZRA ROAD KOLKATA 700019, WEST BENGAL, INDIA

⁴IRDM FACULTY CENTRE, SCHOOL OF AGRICULTURE AND RURAL DEVELOPMENT, RAMKRISHNA MISSION VIVEKANANDA UNIVERSITY, NARENDRAPUR CAMPUS, KOLKATA 700103

Rice is one of the most important staple food crops for billions of people throughout the world. It is the cheapest source of dietary energy, protein and minerals for people but poor in micronutrients such as Fe and Zn to eliminate "hidden hunger". In present study forty diverse rice genotypes from different centre of origin namely India, Japan, Philippines, China and United States and a population of 126 F7 recombinant inbred lines developed from a cross between Lemont and Shatabdi were used to identify high iron and zinc content with yield and yield attributing traits. Analysis of Variance revealed that a considerable variation was present among genotypes. GCV and PCV both were maximum in case of yield per plant and days to maturity. Positive significant correlation was observed in number of filled grains with panicle length and also in yield per plant and number of panicles but no significant positive correlation was observed between grain zinc content and iron content. Zinc and iron content of rice genotypes showing a wide range and traditional varieties Khitish and Azucena contained almost twice as much iron and zinc compared to widely grown check varieties, IR36 and IR64. Among recombinant inbred lines 57, 124, 29 lines showed high Fe content i.e more than 30 ppm and 24, 6, 9 were high Zn content lines more than 50 ppm. These high Fe and Zn content genotypes can be utilized in future breeding programme as a donor or good source for bio fortification of rice genotypes. **Key words:** biofortification, rice genotypes, iron content, zinc content

DEVELOPMENT AND CHARACTERIZATION OF FLAKED AND PUFFED RICE BASED FUNCTIONAL BREAKFAST SNACKS

SHIV KUMAR AND KAMLESH PRASAD

DEPARTMENT OF FOOD ENGINEERING &TECHNOLOGY, SANT LONGOWAL ENGINERING AND TECHNOLOGY, LONGOWAL, PUNJAB.-148106 (INDIA)

Cereal based breakfast items of rice are available in market but the process of manufacturing is limited to small scale and lacks scientific approach. Flaked and puffed rice was developed from Gurjari rice variety and changes taking place during its production were determined. Flaked rice is often roasted before it is used for the preparation of popular traditional snacks. The changes incurred on roasting of flaked

rice were studied. Edible chocolate coating with functional ingredients was applied to enhance acceptability further and make the product functional. Levels of coating ingredients were optimized based on central composite rotatable design experimental findings. The optimized chocolate coated roasted flaked rice (CCFR) and puffed rice (CCPR) was studied for selected engineering characteristics in addition to storage studies at different temperatures from 5-35 °C with an interval of 10°C in LDPE and laminate pouches. The flaking process had a profound effect on dimensional characteristics. Although, the differences were non-existent in moisture, protein and carbohydrates but the variation was evident in gravimetric, frictional, optical and textural characteristics on flaking. The scanning electron micrographs presented a tangible picture of damaged starch granules aroused due to the process of flaking. A significant difference existed in dimensional and gravimetric properties on puffing. Resistant starch and water absorption capacity of puffed rice was significantly (p<0.05) higher than white rice whereas the hardness was vice versa. Pasting properties showed to decline in final viscosity of puffed rice. Flaked rice was roasted in custom made roaster equipped with temperature control roasting pan. The time (26-28s) and temperature (272-328°C) combination of roasting was optimized. The moisture content of roasted rice decreased from 9.97 to 4.58% whereas an increase in resistant starch content from 1.62 to 2.55% was observed. The process of flaking has reduced final viscosity. The dimensions of both roasted flaked and puffed rice increased with coating. The dependency of surface area and geometric mean diameter on main dimensions also led to their increase in both coated rice based products. The sensory scores of both samples increased with coating process, while milk absorption capacity decreased. The developed CCFR and CCPR remained sensory acceptable till six months of storage. Iron deficiency is the most common nutritional inadequacy and supplementation with iron in coating material further added the additional benefits to the developed coated products. As, more than half of the world's population uses rice as staple food, thus the developed highly sensory acceptable, shelf stable, ready-to-eat cereal based functional breakfast food item may act as an important vehicle to solve the associated nutritional problem and find the place among the highly acceptable food items including the celiac subjects being gluten-free food. Keywords: Flaked rice, puffed rice, roasting, coating, breakfast snacks, functional food

GENOTYPE X ENVIRONMENT INTERACTION AND STABILITY ANALYSIS USING EBERHART AND RUSSELL MODEL FOR YIELD IN SINGLE CROSS HYBRIDS IN MAIZE (Zea mays L.)

SIDDHARTH PANDA^{1*}, MRUTHUNJAYA C. WALII¹, R.M. KACHAPUR² AND S.I. HARLAPUR²

¹DEPARTMENT OF GENETICS AND PLANT BREEDING, COLLEGE OF AGRICULTURE, UAS, DHARWAD, KARNATAKA, INDIA

²ALL INDIA COORDINATED RESEARCH PROJECT ON MAIZE, MARS, DHARWAD, KARNATAKA, INDIA

Study of the stability of maize hybrids with respect to different environments is essential to know their adaptiveness and should be considered a pre-requisite for breeding schemes. In this programme, 48 single cross experimental maize hybrids developed from 16 lines and three testers in Line X Tester design were evaluated at three diverse environments, *viz*. Arabhavi (Northern dry zone), Agriculture Research Stations of Nippani (Northern transition zone) and Main Agricultural Research Station (MARS) Dharwad (Northern transition zone) in Karnataka, for their grain yield stability. These hybrids along with 3 checks; GH-0727, CP-818 and NK-6240 were sown in Randomised Block Design across the three locations during kharif-2016. Windostat Version 8.1 was used in performing the stability a analysis following Eberhart and Russell (1966) model. Out of all the hybrids, two of them outcrossed the performance of the best check (NK-6240). The hybrids; GH-1514 (91 q/ha) and GH-1532 (83 q/ha) had the best mean values but their regression values were significantly differed from unity showing adaptiveness to high input cultivation.

Keywords: Maize, Line X Tester, Stability, multi location

AGROFORESTRY FOR ACHIEVING FOOD AND NUTRITIONAL SECURITY *YOGESH KUMAR, V.M. PRAJAPATI AND MOHIT HUSAIN

DEPARTMENT OF SILVICULTURE AND AGROFORESTRY, COF, ASPEE COLLEGE OF HORTICULTURE AND FORESTRY, NAVSARI AGRICULTURAL UNIVERSITY, NAVSARI – 396 450, GUJARAT, INDIA

Agroforestry is practiced by more than 1.2 billion people worldwide. Agroforestry systems provide a variety of products and services that are important for locally, nationally and globally, but their role is not always acknowledged adequately in development policies and practices, possibly reflecting the difficult-to-measure, diverse pathways by which they affect peoples' lives. Relatively low-input agroforestry options are often favoured by women who are unable to afford high-cost technologies due to severe cash and credit constraints. Reaching food and nutritional security requires a range of interconnected approaches from increasing the crop yield and soil fertility, bio fortification of staple foods to cultivating wide range of plants which provide edible fruits, vegetables, nuts and diversify the diets of the people. However, farming communities around the world use more exotic crop varieties and lesser indigenous varieties which are often richer in nutrients, fibres and protein sources than the conventional staple crops. These indigenous verities have been harvested from forests by local communities as NTFPs (Non Timber Forest Products). However, the use of these food sources is threatened due to rising deforestation and fragmentation of climate change impacts and resilience of environmental functions. Hence, global focus on the use of agroforestry as a tool to achieve those objectives should be increased and refined due to its ample positive social and environmental benefits.

Keywords: Agroforestry, Policy, Benefits, Nutritional security.

NAPHTHALIMIDE-BASED DONOR-ACCEPTOR ORGANIC SMALL MOLECULES FOR BIO-IMAGING APPLICATIONS ANKITA SAINI^{1, 2} AND K. R. JUSTIN THOMAS¹

¹DEPARTMENT OF CHEMISTRY, INDIAN INSTITUTE OF TECHNOLOGY ROORKEE, ROORKEE, UTTARAKHAND ²DEPARTMENT OF CHEMISTRY, BABA FARID COLLEGE, DEON, BATHINDA-151001 (INDIA)

A set of naphthalimide-based D-A organic small molecules highlighting different chromophores varying in conjugation and electron richness, at imidic position are synthesized, characterized and demonstrated in bio-imaging applications. These fluorescent amine-functionalized naphthalimides exhibited interesting photophysical, electrochemical and morphological variations attributable to the nature of the N-substituents. The structural variations helped to fine tune the morphology of the dyes at microscopic level. They display unique

and uniform morphology dependent on concentration and time of growth of their molecular structure. Nevertheless, they exhibited variations in morphology at microscopic level, these organic dyes displayed bio-compatibility and are used in the bio-imaging of cells. **Keywords**: Naphthalimide, Organic D-A molecules, Photophysical properties, Morphology, Bio-imaging

MARKETING OF CAPTURED FISH IN LOKTAK LAKE OF MANIPUR

N. CHINGLEN MEITEI^{1*} AND RAM SINGH²

¹DEPARTMENT OF AGRICULTURAL ECONOMICS, UTTAR BANGA KRISHI VISWAVIDYALAYA, PUNDIBARI- 736165, WEST BENGAL.

²DEPARTMENT OF AGRICULTURAL ECONOMICS, COLLEGE OF POST GRADUATE STUDIES, CENTRAL AGRICULTURAL UNIVERSITY, UMIAM- 793 103, MEGHALAYA.

Loktak Lake is a natural treasure for Manipur and plays a significant role in the economy of the state. The fish production of the state was mainly contributed by the Loktak Lake which is the largest fresh water lake in North east India. Loktak is home for 48 different species of fishes under 5 order 17 family 33 genera. For the present study 60 respondents were drawn from the selected four villages using randomly proportionate to size of total number of fishermen engaged in Loktak Lake. Primary informations were collected using pre tested structured schedule through personal interview of the respondents for the calendar year 2016-17. Moirang market and Imphal market were selected purposively on the basis of highest quantity of products disposed off. Channel-I was found to be most popular. Price spread of fisherman was observed highest in channel-II ($\gtrless 250.00$ /kg). Marketing efficiency was found to be highest in channel-II.

Key words: Loktak Lake, Marketing Channel, Marketing cost, Price spread, Marketing efficiency

EFFICACY OF FUNGICIDES AND BIOAGENTS AGAINST *PYTHIUM APHANIDERMATUM* CAUSING RHIZOME ROT OF TURMERIC

CHAVAN, P. G., APET, K. T. AND GHANTE, P. H.

DEPARTMENT OF PLANT PATHOLOGY, VASANTRAO NAIK MARATHWADA KRISHI VIDYAPEETH, PARBHANI - 431 402, MAHARASHTRA, INDIA

Rhizome rot (*Pythium aphanidermatum*) is one of the most wide spread, destructive disease of turmeric (*Curcuma longa* L.), which accounts for about 30 to 80 per cent yield losses. All the fungicides tested significantly inhibited mycelial growth of *P. aphanidermatum*, over untreated control. Average mycelial growth inhibition recorded with the test systemic fungicides was ranged from 73.32 (Propiconazole) to 100 (Metalaxyl) per cent. However, it was cent per cent with Metalaxyl (100 %), followed by Carbendazim (97.67 %), Azoxystrobin (94.55 %), Thiophanate methyl (94.15 %), Fosetyl-AL (86.64 %), Hexaconazole (85.76 %) and Difenconazole (82.85). Whereas, it was comparatively minimum with Propiconazole (73.32 %) and Penconazole (81.14 %). Average mycelial growth inhibition recorded with the test non systemic and contact fungicides was ranged from 50.94 (Metalaxyl 8 % WP + Mancozeb 64 % WP) to 100 (Carbendazim 12 WP + Mancozeb 63 WP) per cent. However, Carbendazim 12 WP + Mancozeb 63 WP gave cent per cent (100 %) mycelial inhibition. The next fungicides with significantly least mycelial growth were Copper oxychloride (97.36 %), followed by Chlorothalonil (76.16 %), Mancozeb (70.62 %). However, Metalaxyl 8 % WP + Mancozeb 64 % WP and Cymoxanil 8 % + Mancozeb 64 % WP were found less effective with minimum mycelial inhibition of 50.94 and 55.23 per cent, respectively.

Key words: Curcuma longa, Pythium aphanidermatum, fungicides, bioagents, management

REPLACEMENT OF SUGAR BY JAGGERY IN THE DEVELOPMENT OF IRON RICH MIXED FRUIT CHEESE

RATTAN SINGH, RAKESH GEHLOT, REKHA, RITU SINDHU AND SANDEEP KUMAR CENTRE OF FOOD SCIENCE AND TECHNOLOGY, CCS HARYANA AGRICULTURAL UNIVERSITY, HISAR-125 004, HARYANA, INDIA

The health awareness among the people of world is rising day by day and leads to demand of food products containing functional ingredients. Due to this demand and needs of people, iron rich banana-guava mixed fruit cheese was developed by replacing sugar with jaggery. Jaggery is a natural, traditional sweetener made by the concentration of sugarcane juice and it is rich in important minerals like Calcium-40-100 mg, Magnesium-70-90 mg, Potassium-1056 mg, Phosphorus-20-90 mg, Sodium-19-30 mg, Iron-10-13 mg, Manganese-0.2-0.5 mg, Zinc-0.2- 0.4 mg, Copper-0.1-0.9 mg, and Chloride-5.3 mg per 100 g jaggery. It is digested slower and provides energy for a longer time. Pulp of ripe banana fruit is affluent in vitamin A and B, and contains 18% sugar. It is also rich in carotenoids (735 mg/100 g), ascorbic acid (12.7 mg/100 g) and citric acid. Guava is an excellent source of ascorbic acid and has about four times more vitamin C than oranges. Fruit cheese is very popular among children due to its excellent taste and flavour. Blending pulp of two different fruits like banana and guava helps in improving the nutrition and overall acceptability of the product. The mixed fruit cheese was developed using 40% banana and 60% guava pulp. The other ingredients include 70 g butter, 900 g sugar, 5 g salt and 4 g citric acid for one kg pulp. The 25% sugar was replaced by jaggery for the development of jaggery based iron rich banana-guava cheese.

Key words: Mixed fruit cheese, banana, guava, iron rich, jaggery

EVALUATION OF PESTICIDAL EFFICACY OF SILVER MYCONANOPARTICLES AGAINST WHITE GRUB (HOLOTRICHIA SP) AND PATHOGENIC FUNGI.

VARSHA RANI AND S.S. GAURAV

DEPARTMENT OF BIOTECHNOLOGY, CHAUDHARY CHARAN SINGH UNIVERSITY, MEERUT (U.P.)

Crop production in India has suffered greatly due to attacks by various pests and fungi. In the present study the fungicidal efficacy of silver nanoparticles was tested against the fungi Phytopthora infestans and Aspergillus flavus, which led to late potato and ear rot in maize. Pesticide efficacy was tested against white gram, a powerful sugarcane insect in western Uttar Pradesh. AgNPs were synthesized using Aspergillus niger and by color-based method, laser-beam, UV-vis spectroscopy and scanning electron microscopy (SEM). AgNPs were

tested against various life-cycle stages of the fungi Phytopthora infestans and Aspergillus flavus and white grubs. The development of a mustard color solution such as paint by a color-based detection method confirmed the synthesis of AgNPs. The formation of AgNPs was also confirmed by laser beam scattering. UV – vis spectroscopy showed a peak at 400–425nm corresponding to ANGNP. The SEM result has confirmed the synthesis of nanoparticles ranging in size from 72nm to 95nm. Media treated with AgNPs showed clear inhibition of fungal growth. AgNPs were also found to interfere with the white-grub's life-cycle. Pupa could not undergo insect-like development and died. First-instar and third-instar larvae were also killed with AgNPs treatment in 30-45 min time.

Key words: Silver nanoparticle, myconanoparticles, nanopesticide, white grub, late-blight disease, ear rot, *Phytopthora infestans*, *Aspergillus flavus*, *Aspergillus niger*.

MULTI SUMMATION IDENTITIES INVOLVING RATIO OF Q-BASIC INFINITE PRODUCTS

A. K. SHRIVASTAV

DEPARTMENT OF MATHEMATICS, RIMT UNIVERSITY, PUNJAB-147301.

Some Rogers-Ramanujan multi sum identities can be expressed in terms of infinite products. In this paper, an attempt has been made to establish the certain results involving the multi summation expressions and ratio of q-basic infinite products by using well known m-dissections of the power series.

Key words: Bailey pair's, bailey lemma, m-dissection, rogers-ramanujan type identities.

NANOTECHNOLOGY: AN INNOVATIVE SOLUTION FOR WASTE WATER PURIFICATION

HARI OM SHARMA¹, SUNIL KUMAR SINGH²

¹DEPARTMENT OF CHEMISTRY, C.C.R. (P.G.) COLLEGE, MUZAFFARNAGAR (UP) ²DEPARTMENT OF AGRICULTURE BOTANY, C.C.R. (P.G.) COLLEGE, MUZAFFARNAGAR (UP)

Water is the most important asset of human civilization and without water no one imagine the life. It is critical to the survival of all living organisms. Much of the earth fresh water is unsuitable for drinking purpose without some treatment. Since the demand of pure water globally increases day by day and nowadays it becomes a challenging problem. Demand escalates due to population growth, global climate change, and water-quality deterioration. Only 2.5 to 2.75% is fresh water including 1.75 to 2% frozen in glaciers, ice, snow, 0.5 to 0.75% as fresh ground water and soil moisture. Only 0.01% of fresh water can be used for drinking. Globally, around 700 million people do not have access to potable water. This problem is severe in developing nations and sub-Saharan African countries. Therefore, water treatment must be implemented in these affected places. Available technologies for water treatment are reaching their limits in providing sufficient quality to meet human and environmental needs. Therefore, reuse, recycle, and repurpose are the needs of the day. There are several ways to purify water such as water conditioners, activated carbon water filters, ultraviolet water filters, water sand filters, reverse osmosis etc. Recently nanotechnology provided innovative solutions for water treatment. Nanomaterials are fabricated with features, such as high aspect ratio, reactivity, and tunable pore volume, electrostatic, hydrophilic and hydrophobic interactions, which are useful in adsorption, catalysis, sensoring, and optoelectronics. Nanomaterials are typically less than 100 nm in dimension and contain materials with novel and significantly changed physical, chemical, and biological properties. It has been shown that nanostructured materials can improve present polymeric and ceramic water treatment membranes. The most promising nanomaterials for this field include catalytic and zeolitic nanoparticle-coated ceramic membranes, isoporous block copolymer membranes, aligned nanotube membranes, bio-inspired membranes like hybrid protein-polymer biomimetic membranes and hybrid inorganic-organic nanocomposite membranes. It must be noted that bioinspired membranes are very far from commercial reality, but have shown highly promising performance enhancements in studies. Ongoing research proves that nanotechnology can contribute significantly to the advancement of water treatment technology. **Key words:** Nanomembranes, sensors, optoelectronics, zeolitic membranes

ASSESSMENT OF CLIMATE INDUCED VULNERABILITY AMONG THE TRIBAL DAIRY FARMERS OF HIMACHAL PRADESH

CHANDAN KUMAR RAI¹, GOPAL SANKHALA¹, ARTI², SUNIL KUMAR¹ AND SANJEEV KUMAR¹ ¹DAIRY EXTENSION DIVISION, ICAR-NATIONAL DAIRY RESEARCH INSTITUTE, KARNAL-132001, HARYANA, INDIA ²DES&M, ICAR-NATIONAL DAIRY RESEARCH INSTITUTE, KARNAL-132001, KARNAL-132001, HARYANA

Presently, the threat of climate change poses a challenge for sustainable agricultural growth. The global climate change would also have substantial impact on the livestock sector. Tribal farmers are very close to nature, and mostly dependent on dairying for their livelihood. They are most affected to climate variability and change. The present study was formulated to assess climate induced vulnerability at the household level among the tribal dairy farmers of Himachal Pradesh. Total 160 tribal farmers were randomly selected from the Una and Sirmaur district of Himachal Pradesh. An exclusively "Social Vulnerability to Climate Change" index was developed by considering 42 indicators underlying the principle of IPCC. The study revealed that among the studied districts, villages of Sirmaur district were comparatively higher vulnerable than the villages of Una district. The index score of vulnerability of tribal livestock rearers were ranged between -0.63 to 1.45 with the mean value of 0.18. Majority (52.50%) of the tribal dairy farmers were moderately vulnerable. Among all the indicators of adaptive capacity and 'milk production' had the highest influence to overall adaptive capacity with a weightage of 6.17. In case of sensitivity, 'market distance for buying and selling' (3.09) was the most sensitive indicator of vulnerability. Findings of this study may help the policy makers for developing climate preparedness to enhance resilience capacity of the tribal dairy farmers of the mountain agro-ecosystem.

Key words: Adaptive capacity, Climate change, Livestock farming, Tribal dairy farmers, Vulnerability

SUSTAINABLE AGRICULTURE DEVELOPMENT IN INDIA NAAZ BANO¹ AND² RAJESH DAHIYA

DEPARTMENT OF EXTENSION EDUCATION AND COMMUNICATION MANAGEMENT, CCS HAU, HISAR,

"Sustainable agriculture is farming in sustainable ways, meeting society's food, textile and clothing needs in the present without compromising the ability of future generations to meet their own needs." The position of agricultural sector in Indian economy can be seen through its contribution to GDP (Gross domestic Product) and employment. This sector also contributes considerably to sustainable economic development of the country. The sustainable agriculture development of any country depends upon the careful use of their available natural resources. In fact agriculture decide the fate of a country like India where about two-thirds of the population still lives in rural areas with agriculture as its livelihood, in despite of the increasing urbanization that has been taking place since many decades. Therefore if agriculture goes wrong, it will be actually bad for the economy as the declining of agricultural growth not only affects employment but GDP too. The larger objective for the enhancement of agriculture sector can be realized through fast growth of agriculture, which depends upon increasing the area of cultivation, cropping intensity, and productivity. But for a country like India, rising productivity is more essential than the rest of the two. This is merely because of increasing industrialization urbanization, and the limited land size of the country. Increased agricultural efficiency and rapid industrial growth in the recent years have contributed in the direction of a significant reduction in poverty level. The productivity can be increased by two ways. First, increase production by wise utilization of available resources. Second, increase output by variation of input. The first process is better with respect to productivity and sustainability. But due to increasing population, this method cannot provide a everlasting solution. Thus, we can go for the second method, which may potentially cause environmental degradation in the economy and have an effect on its sustainability.

Key words: Agriculture, economy, sustainable, development

POPULATION FLUCTUATION OF BRINJAL SHOOT AND FRUIT BORER (LEUCINODES ORBONALIS GUENEE) IN AYODHYA DISTRICT OF UTTAR PRADESH

ANKUR PRAKASH VERMA^[1], UMESH CHANDRA^[3] HEM SINGH^[1], ANUJ SHAKYA^[2], VINOD KUMAR^[1] AND PANKAJ BATHAM^[1]

¹DEPT. OF ENTOMOLOGY, SARDAR VALLABHBHAI PATEL UNIVERSITY OF AGRICULTURE & TECHNOLOGY, **MODIPURAM, MEERUT- 250110**

²DEPT. OF ENTOMOLOGY, CHANDRA SHEKHAR AZAD UNIVERSITY OF AGRICULTURE & TECHNOLOGY, KANPUR- 208002

³DEPT. OF ENTOMOLOGY, NARENDRA DEVA UNIVERSITY OF AGRICULTURE & TECHNOLOGY, KUMARGANJ, **AYODHYA- 224229**

The present investigations were carried out during the Kharif season, 2017-18 at Student's Instructional Farm, N. D. University of Agriculture and Technology, Kumarganj, Ayodhya (U.P.). The incidence of insect brinjal shoot and fruit borer (Leucinodes orbonalis Guenee) was recorded. The incidence of brinjal shoot and fruit borer was noticed for the first time from 39th SW onwards. Maximum and minimum shoot infestation was recorded in 48th SW and 4th SW i.e. 7.42 and 0.13 shoot damage/plant respectively. Maximum and minimum fruit infestation was recorded in 48th SW and 4th SW i.e. 8.04 and 0.81 fruit damage/plant respectively. Correlation coefficient was worked out between the incidence of insect pest and abiotic factors. In case of shoot infestation by Brinjal shoot and fruit borer, the correlation was positive with maximum temperature (0.1324) while it was negative with minimum temperature (-0.1063), RH (-0.6575) and rainfall (-0.4029). In case of fruit infestation by Brinjal shoot and fruit borer, the correlation was negative with minimum (-0.4270) and maximum temperature (-0.1901) as well as with RH (-0.6299) and rainfall (-0.3554).

Key words: SW (Standard week), brinjal shoot and fruit borer, Correlation coefficient.

CLIMATE IMPACT ON SPIDER MITE (TETRANYCHUS SP. KOCH) INFESTING SOM PLANT LEAVES (MACHILUS BOMBYCINA KING) AND THEIR CONTROL USING PHYTO-CHEMICALS

TANMOY MANDAL₁, SUNIL KR. GHOSH₂* AND KAUSHIK CHAKRABORTY₃

¹DEPTT. OF PLANT PROTECTION, SURI VIDYASAGAR COLLEGE, SURI, BIRBHUM, WEST BENGAL, INDIA

²DEPARTMENT OF AGRICULTURAL ENTOMOLOGY, BCKV-AGRICULTURAL UNIVERSITY, AINP ON AGRIL. ACAROLOGY, DIRECTORATE OF RESEARCH, KALYANI, NADIA, WEST BENGAL, 741235, INDIA

³DEPARTMENT OF ZOOLOGY, UNIVERSITY OF GOUR BANGA, MOKDUMPUR MALDA, 732103 W.B.

Som plant (Machilus bombycina King) is an important plant in agroforestry system. It is cultivated in north -east part of India. It is cultivated in agricultural land by the marginal farmers for multi-storeyed cultivation with intercropping. Localized cottage industries are involved with this plant like sericulture industry (muga silk worm cultivation). Clothes are produced from this sericulture industry. Leaves of som plants are major food of muga silk worm (Antherea assama). Nutritional value of leaves plays an important role in the larval growth and silk productivity. The plant also has timber value. The plant is susceptible to mite pest (Tetranychus sp.) causes heavy damage to tender leaves. Lower population was recorded during 7th to 38th standard week, during 3rd week of February to 4th week of September and higher population was during 46th to 51st standard week, during 3rd week of November to 3rd week of December and peak population (6.06/3 leaves) was recorded on 46th standard week that is on 3rd week of November. Correlation studies revealed that mite population had a significant negative correlation with temperature and non-significant positive correlation with relative humidity. This indicates that activity of mites population increase with the rise of relative humidity and decrease with the rise of temperature. Tobacco leaf extracts was found most effective against mite providing 40.51% suppression, closely followed by extracts of Spilanthes (39.06% suppression). Extracts of Garlic and extracts of Polygonum plant gave moderate results, recording about 38.10% and 37.78% mite suppression respectively. The polygonum (Polygonum hydropiper) plant (floral parts), pongamia (Pongamia pinnata) leaves, garlic (Allium sativum), spilanthes (Spilanthes paniculata) (floral parts) were extracted in methanol. Synthetic insecticides contaminate plant leaves with the toxic chemicals. Plant extracts are of biological origin having low or no hazardous effect on health and environment and so can be incorporated in organic cultivation.

Key words: Abiotic factors, incidence, botanical extracts, organic cultivation, silk industry

PLANT PROTECTION AND QUARANTINE IN INDIA

CHIRAG THAKAR¹, NIKUNJ JOSHI², NARESH SOLANKI³

^{1.3}DEPARTMENT OF VEGETABLE SCIENCE, COLLEGE OF HORTICULTURE, SARDARKRUSHINAGAR DANTIWADA AGRICULTURAL UNIVERSITY, JAGUDAN – 384460, GUJARAT

²DEPARTMENT OF FRUIT SCIENCE, COLLEGE OF HORTICULTURE, SARDARKRUSHINAGAR DANTIWADA AGRICULTURAL UNIVERSITY, JAGUDAN – 384460, GUJARAT

Plant quarantine may be defined as the restriction imposed by duly constituted authorities on the production, movement and existence of plants or plant materials. It prevents the diseased and infected plant materials to transfer into different areas within country and across the country. When plant pathogens are introduced into an area in which they did not previously exist, they are likely to cause much more catastrophic epidemics than the existing pathogens. Some plant disease epidemics that have occurred through out the world, for example the downy mildew of grapes and the bacterial canker of citrus has spread through out the world. These epidemics are very difficult to control and damage the crop of particular area and region. The National Plant Quarantine Station at Rangpuri, New Delhi and four Regional Plant Quarantine Stations at Amritsar, Chennai, Kolkata and Mumbai are the major stations in India. Plant quarantine regulatory operate through the destructive insect & pest Act, 1914. Main objective of plant quarantine is to prevent the introduction and spread of exotic pests that are destructive to crops. There are 35 Plant quarantine Stations at different Airports, Seaports and Land frontiers implementing the Plant Quarantine regulations for Inspection of imported agricultural commodities for preventing the introduction of exotic pests and diseases inimical to Indian fauna and flora. Phytosanitary certificate is provide after inspection based on scientific justifications conduct all Plant Quarantine inspections as per the International Standards/guidelines before importing planting material from other countries. The phytosanitary certification of agricultural commodities being exported is also undertaken through the scheme as per International Plant Protection Convention (IPPC), 1951. The plant quarantine scheme helps to prevent spread of disease epidemics. In India, where more than half of population depend on agriculture sector, plant quarantine regulatory is very important to protect vegetation and reduce cultivation cost to control that disease epidemics.

AGRICULTURAL DEVELOPMENTAL PROGRAMMES AND THEIR STRATEGIES

NARESH SOLANKI¹, HASMUKH LEUA, NIKUNJ JOSHI

¹DEPARTMENT OF VEGETABLE SCIENCE, COLLEGE OF HORTICULTURE, SARDARKRUSHINAGAR DANTIWADA AGRICULTURAL UNIVERSITY, JAGUDAN – 384460, GUJARAT

DEPARTMENT OF FRUIT SCIENCE, COLLEGE OF HORTICULTURE, SARDARKRUSHINAGAR DANTIWADA AGRICULTURAL UNIVERSITY, JAGUDAN – 384460, GUJARAT

India is an agricultural country with 144 million hectares of land is under cultivation which is highest in the world. It is second largest populated country in the world and its more than half of population depends on agriculture sector. So, it is necessary to achieve rapid increase in the level of agriculture production through concentrate on different agricultural development programs. There are many agricultural development programs are launched after independence to make Indian farming system self-sufficient. Intensive Agriculture Development Program (IADP) 1960 by which loan, seeds, fertilizer tools, etc. are provided to the farmers at lower price to reduce input cost. It was launched as pilot basis in one district of 7 states at that time and after few year of its launching production of wheat as well rice increased in that state rapidly as compare to other state. India produced 23.5 Lakh tones of wheat in 1964-65 compared to 17 Lakh tons in 1961. Soil Health Card (2015) which provide information to farmers on nutrient status of their soil along with recommendation on appropriate dosage of nutrients to be applied for improving soil health and its fertility. Neem Coated Urea (NCU) this scheme is initiated to regulate use of urea, enhance availability of nitrogen to the crop and reduce cost of fertilizer application. Pradhan Mantri Krishi Sinchai Yojana (2015), which has the motto of 'Har Khet Ko Paani' for providing in irrigation supply chain, viz. water sources, distribution network and farm level applications. National Agriculture Market (e-NAM), which provides e-marketing platform for ensuring better price discovery. It brings in transparency and competition to enable farmers to get improved remuneration for their produce moving towards 'One Nation One Market'. Micro Irrigation Fund created by NABARD for encouraging public and private investments in Micro irrigation. By this agricultural development programs farmers become aware to adopt new technologies and cultivation practices for improving their farming.

EFFECT OF ALTERNATE WETTING AND DRYING (AWD) IRRIGATION METHOD ON YIELD AND QUALITY PARAMETERS OF DIFFERENT RICE (*ORYZA SATIVA* L.) VARIETIES IN PUDDLED SOIL M. SHARATH CHANDRA¹, K. AVIL KUMAR²

DEPARTMENT OF AGRONOMY, COLLEGE OF AGRICULTURE, JAYASHANAKAR TELANGANA STATE AGRICULTURAL UNIVERSITY, RAJENDRANAGAR, HYDERABAD - 500 030

A field experiment was conducted on sandy clay soil at Agricultural College farm, Rajendranagar, Hyderabad during *kharif*, 2016 in a split plot design with three replications. The treatments comprised of three irrigation regimes (irrigation of 5 cm when water level falls below 5 cm from soil surface in field water tube, irrigation of 5 cm, at one day after disappearance of water on the surface of the soil and recommended submergence of 2-5 cm water level as per crop stage) as main treatments and four rice varieties (Telangana sona, Kunnaram sannalu, Bathukamma and Sheethal) as sub plots treatments. Based on the research results, it can be concluded that recommended submergence of 2-5 cm water level recorded significantly higher grain yield (6289 kg ha⁻¹), straw yield (6049 kg ha⁻¹) and head rice recovery (64.7 %) over AWDI of 5 cm when water falls below 5 cm from soil surface in field water tube and was on par with AWDI of 5 cm at one DADSW. Bathukamma recorded significantly higher grain and straw yield (6468 kg ha⁻¹ & 7755 kg ha⁻¹) than Telangana Sona, Sheethal and was at par with Kunaram Sannalu in grain yield and on par in straw yield with Sheethal. Significantly higher hulling, milling and head rice recovery percentage (83.2, 69.8 and 64.6 %) was with Bathukamma than Kunaram Sannalu, Telangana Sona and was at par with Sheethal.

RESPONSE OF SUGARCANE (*SACCHARUM* SPECIES HYBRID) GENOTYPES TO VARIED CONCENTRATION OF 6-BENZYLAMINOPURINE (6-BAP) AND KINETIN IN LIQUID MEDIUM FOR RAPID *IN VITRO* SHOOT MULTIPLICATION.

SURESH YADAV^{1*,2}, T. E. NAGARAJA², AND H. C. LOHITHASWA²

¹ DIVISION OF GENETICS, ICAR-INDIAN AGRICULTURAL RESEARCH INSTITUTE, NEW DELHI 110 012 ²COLLEGE OF AGRICULTURE, V.C. FARM MANDYA, UNIVERSITY OF AGRICULTURAL SCIENCES, BENGALURU

Sugarcane (*Saccharum* species hybrid), is an important cash crop and is the major source of sugar worldwide. Studies were carried out for rapid micropropagation of two sugarcane genotypes Co-86032 and CoVC-18061. The cultures were initiated by inoculating shoot apical meristem on MS (Murashige and Skoog, 1962) medium containing 1.0 mg/l kinetin. The multiplication response of two sugarcane genotypes was studied under five levels of 6-Benzylaminopurine (0, 0.5, 1, 1.5 and 2 mg/l) and five levels of kinetin (0, 0.25, 0.5, 1.0 and 1.5 mg/l) in completely randomized design with 5x5x2 factorial treatment combinations. Analysis of variance (ANOVA) showed that the interaction effects of 6-benzlyaminopurine (6-BAP), kinetin and the sugarcane genotypes on number of shoots per explant, shoot length, and chlorophyll content was highly significant (p< 0.001), except for number of leaves. The optimum multiplication for genotype Co 86032 was obtained when MS media supplemented with 1.0 mg/l 6-BAP and 0.5 mg/l kinetin as this genotype produced 32.5 shoots per explant with 6.32 cm shoot length, 2.83 leaves and chlorophyll content of 20.78 mg/g. best performance of CoVC-18061 with respect to number of shoot per explant (27.75), shoot length (7.03) with number of leaves (2.81) and chlorophyll content (22.83 mg/g) was obtained on MS medium fortified with combination of 1.5 mg/l BAP and 0.5 mg/l kinetin after 30 days of culture transferred to multiplication media. The performance of genotype for all characters was very poor in MS medium amended with other combinations. Thus, the optimized protocol will useful in rejuvenation and rapid *in vitro* propagation and production of large quantity of quality plants.

PRECISION AGRICULTURE, SOIL AND WATER CONSERVATION FOR SUSTAINABLE AGRICULTURAL SYSTEM RAMARAO AND DESAI, B. K

DEPARTMENT OF AGRONOMY, UAS, RAICHUR

Global population expected to reach 9.1 billion in 2050 and over 10 billion by end of century will require major changes in agricultural production systems. So proper management of soil and water is key to increase crop productivity without further degrading soil and water resources. At the same time, sustainable agriculture has the potential to deliver co-benefits in the form of reduced GHG emissions and increased carbon sequestration therefore contributing to climate change mitigation. Sustainable agriculture means meeting society's food and textile present needs, without compromising the ability of future generations to meet their needs. Precision agriculture is an approach to farm management that uses information technology to ensure that the crops and soil receive exactly what required for optimum health and productivity. The goal is to ensure profitability, sustainability and protection of the environment. Precision Agriculture can help in managing crop production inputs in an environmentally friendly way. By using site-specific knowledge, PA target rates of fertilizer, seed and chemicals for soil and other conditions, environment benefit come from more targeted use of inputs that reduce losses from excess applications, weed escapes, insect damage, etc. Soil erosion is one of the several major destructive processes which results in deterioration of the soil. Soil erosion may lead to the significant loss of soil productivity and thus may lead to the desertification under sever conditions. Deforestation, over-grazing, mismanagement of cultivated soils, intensive cultivation and intensive urbanization are major factors triggering the soil erosion. For sustainable agriculture and environment, it is pertinent for the protection of soil resources against erosion. Different control measures should be adopted to protect the soil resources against erosion. Soil conservation practice include soil management, crop management, engineering, range management and forestry operation. Precision Agriculture can help in managing crop production inputs in an environmentally friendly way. By using site-specific knowledge, PA can target rates of fertilizer, seed and chemicals for soil and other conditions. PA substitutes information and knowledge for physical inputs. Precision agriculture benefits to the Key words: Soil, Water, Erosion, Conservation, Management

ANTAGONISM OF NATIVE AND COMMERCIAL TRICHODERMA SPP. AGAINST FUSARIUM SOLANI ISOLATES CAUSING ROOT ROT OF PAPAYA (CARICA PAPAYA L.)

PRINCE KUMAR GUPTA1*, MANOJ KUMAR CHITARA2, SANJAY KUMAR SINGH1,

¹DEPARTMENT OF PLANT PATHOLOGY, DR. RAJENDRA PRASAD CENTRAL AGRICULTURAL UNIVERSITY PUSA, SAMASTIPUR, BIHAR, 848125

²DEPARTMENT OF PLANT PATHOLOGY, G. B. PANT UNIVERSITY OF AGRICULTURE AND TECHNOLOGY, PANTNAGAR, UTTARAKHAND, 263145

Fusarium solani listed in most notorious among the top ten plant pathogen. It is a soil-borne plant pathogen, caused root rot of the papaya which is responsible for estimate losses up to 40-95 percent. In this study we had collected different isolates of *Fusarium solani* from different districts of Bihar and the five isolates of *Fusarium solani* were selected on the basis of cultural, morphological and disease potential studies then further evaluated the fungus against native and commercial *Trichoderma viride and Trichoderma harzianum* by dual culture technique in the laboratory of the Department of Plant Pathology, DRPCAU Pusa, Samastipur in 2016. Observations were taken at 120 hours and 240 hours for the assessment of their inhibitory effects. In the presence of native *T. viride* and *T. harzianum* the variability in the growth inhibition over control is observed among five isolates, however the maximum growth inhibition was observed in the isolates FS-V (78.1%, 72.5%) and minimum in FS-II (73.1%, 68.1%) respectively, likewise in the presence of commercial *T. viride* and *T. harzianum* spp. maximum growth inhibition observed in FS-V (60.9%, 53.2%) and minimum in FS-II (53.8%, 49.2%) respectively were significantly reduced in comparison to control. Both the native and commercial *Trichoderma* spp. significantly reduced the mycelial growth of *Fusarium solani* isolates in comparison to control.

Key words: Fusarium solani isolates, Trichoderma spp., variability, root rot.

SCREENING OF DEFENSE RESPONSE AGAINST ALTERNARIA BRASSICAE (BERK.) SACC. CAUSING LEAF SPOT IN INDIAN MUSTARD (BRASSICA JUNCEA L.)

DURGESH CHAURASIA¹, VISHAL SRIVASHTAV¹, SHRVAN KUMAR², SONAM PAHUJA¹ ¹PLANT BIOTECHNOLOGY LABORATORY, RAJIV GANDHI SOUTH CAMPUS, BANARAS HINDU UNIVERSITY, BARKACHHA, MIRZAPUR (U.P.) – 231001, INDIA

²DEPARTMENT OF MYCOLOGY AND PLANT PATHOLOGY, BANARAS HINDU UNIVERSITY, VARANASI (U.P.) - 221005, INDIA

Plant biodiversity richness reinforce the ecosystem that moderates climate and provides shelter to sustenance for most of living organisms. The genetic biodiversity of a species rely on its genotype and metabolic activities against stress conditions. In terms of biotic stress, a biochemical investigation was accomplished for evaluation of defense responses against *Alternaria brassicae* in the different varieties of Indian mustard. *A. brassicae* (Berk.) Sacc. is the most destructive pathogen of mustard. It causes a highly destructive disease, Alternaria blight (leaf spot) in mustard and other crucifers. Regulation of defense mechanism against pathogen attack is majorly associated with reactive oxygen species that are produced by plant cellular metabolism. This screening revealed the activity of several enzymatic and non-enzymatic antioxidants that scavenge the 'oxidative-stress'. After infection, the ROS scavenging enzymes i.e. SOD, CAT, APX, GPOX and other antioxidative metabolites viz., total phenol, protein, proline, and chlorophyll content, were elevated in some of the genotypes which can be concluded as tolerant to biotic stress. However, in most genotypes, these antioxidants were found less active as these can be said as susceptible to the pathogen. Among all genotypes, RH-749 was found promising germplasm which showed higher activity in most of the biochemical parameters.

Key words: Sustenance, antioxidants, scavenging enzymes, oxidative stress, germplasm.

EFFECT OF ORGANIC AND INORGANIC FERTILIZER ON GROWTH OF LINSEED (*LINUM USITATISSIMUM* L.) UNDER POPLAR BASED AGROFORESTRY SYSTEM.

GYAN SHRI KAUSHAL, RAJIV UMRAO AND R. VIJAYKUMAR

DEPARTMENT OF SILVICULTURE AND AGROFORESTRY, SHUATS PRAYAGRAJ (U.P.) 211007

A field experiment was conducted with linseed under Poplar during Rabi season of 2018 at crop Research Farm, Department of Silviculture & Agroforestry, SHUATS, Prayagraj, (U.P.). The treatment comprised of FYM 100%, NPK 100%, Control, VC 100%, NPK 50%, FYM 50%, VC 50%, NPK 75%, FYM 75%, VC 75%, NPK 125%, FYM 125%, VC 125% under Poplar based Agroforestry. The experiment was laid out in Randomized Block Design (RBD). The result Showed that maximum plant height (cm), plant diameter (cm²) recorded at 30, 60, 90 and 120 DAT, capsule per plant, seed per capsule were recorded. The treatment (T₁₁) with application of (FYM 125%) showed the significant superiority in giving the maximum plant height (58.41cm at 120 days), plant diameter (4.43cm² at 120 days), capsule per plant (48.93 at 120 days), seed per capsule 9.33. The treatment (T₂) with application of (NPK 100%) showed the significant. These parameters were significantly influenced by different sources and doses of organic and inorganic fertilizer. However, Poplar based Agroforestry system could be rank based on economic performance of linseed also recorded in treatment T₁₁ (FYM 125%).

Key words: Linseed, Growth analysis, Poplar, FYM, VC, NPK,

CHANGES IN PHYSICO-CHEMICAL, MICROBIAL AND ORGANOLEPTIC ATTRIBUTES OF LASSI FORTIFIED WITH CARROT (*DAUCUS CAROTA L.*) JUICE DURING STORAGE AT REFRIGERATED TEMPERATURE

SRISHTI UPADHYAY, PRAFULL KUMAR AND NEERAJ KUMAR DIXIT WARNER COLLEGE OF DAIRY TECHNOLOGY, SHUATS, ALLAHABAD (U.P) – 211007

Lassi is a popular and traditional fermented milk beverage of the Indian subcontinent. Carrot (*Daucus carota L*.) is one of the more commonly used vegetable of human nutrition. It is rich in beta carotene, ascorbic acid, tocopherol and classified as vitaminized food. In the present study lassi was prepared by adding 90% skim milk and 10% carrot juice which was stored at 5-7 $^{\circ}$ C. During the storage period organoleptic evaluation, physico-chemical and microbial analysis of the product was carried out. The sensory evaluation of optimized product during the storage showed that there was continuous decrease in scores of all the sensory parameters. The physico-chemical analysis of lassi during storage showed that carbohydrate, protein, fat, ash, total solids, titratable acidity and antioxidant was increased and pH was decreased. Based on the organoleptic scores and the physico-chemical aspects that were assessed, it was concluded that the product retained its aesthetic value and was acceptable upto 21 days.

Key words: Lassi, Skim milk, Carrot juice, storage study, physico-chemical.

STUDIES ON SENSORY CHARACTERISTICS OF LASSI BY USING WHEY AND MORINGA POWDER NEERAJ KUMAR DIXIT, SK AKTAR HOSSAIN, SRISHTI UPADHYAY AND PRAFULL KUMAR WARNER COLLEGE OF DAIRY TECHNOLOGY, SHUATS, PRAYAGRAJ, U.P.

Lassi is highly refreshing and relishing during hot summer time. Lassi, as such has very good nutritional value. It is considered to be even better than milk. There is a great demand of lassi in the market. So, the investigation is planned with a view to standardized techniques of manufacturing for moringa leaf powder lassi blend with standard milk, sugar and whey. It aims to improve the nutritional value of traditional lassi. The present study was conducted to know the sensory attribute of lassi prepared by blending with dahi, whey and moringa leaf powder. It was prepared from standardization milk. Moringa powder was added at different level viz. 0.5%, 1% and 1.5% and whey. Addition of whey at three different concentration viz. 19.5%, 29% and 38.5% and vanilla flavour for improved quality and acceptability of the product of moringa lassi. Various analysis parameters were analyzed by two way ANOVA to obtained optimum result prepared moringa lassi was subjected to sensory analysis to evaluate the suitability of lassi were sample T0, T1, T2 and T3. The highest mean value of T2 sample of colour and appearance, body and texture, flavour and overall acceptability was observed 8.30±0.31, 7.42±0.54, 8.36±0.20 and 8.20±0.24 respectively.

Key words: curd, whey, sugar, moringa powder, vanilla flavor, sensory

EVALUATION OF RECOMBINANT INBRED LINES (F8) OF SABITA/SAMBAMAHSURI DERIVATIVES FOR YIELD ATTRIBUTING CHARACTERS

ANSHUMAN TIWARI

DEPARTMENT OF GENETICS AND PLANT BREEDING, BIDHAN CHANDRA KRISHI VISHWAVIDYALAYA, MOHANPUR, NADIA, WEST BENGAL.

Study on genetic variation of yield attributing characters was carried out using twenty-three recombinant inbred lines(RILs) designated from S1 to S23 of Sabita/Sambamahsuri derivatives developed at Regional research station, Bidhan Chandra Krishi Vishwavidyalaya, subcentre, Chakdaha, Nadia, West Bengal along with four check varieties viz. Swarna sub-1, Dhanarasi, Sambamahsuri and Sabita during kharif-2015, RBD with two replications. Twenty eight yield attributing characters were studied. Statistical analysis carried out for the estimation of genotypic coefficient of variance (gcv), phenotypic coefficient of variance (pcv), heritability (BS), and genetic advance. A wide spectrum of variation was found among the genotypes against all the characters. The genotypes $S_{11}(32.52)$, $S_{23}(31.63)$, $S_{16}(31.25)$, S12(30.74), S15(30.68) and S2(30.06) were superior in grain yield per plant (g) with the margin of 11.36%, 8.32%, 7.02%, 5.27%, 5.06% and 2.95% respectively as compared to best check varieties. S9, S10, S12, S15, S16, S17, S18, S19 and S20 reported earliness with respect to the best check varieties. S₁, S₂, S₃, S₁₁, S₁₉ and S₂₃ were superior for most of the yield determining traits viz., grain yield per plant, panicle weight, panicle length, number of secondary branches per panicle, number of florets per panicle, number of grains per panicle and harvest index. High estimates of GCV and PCV were obtained for panicle weight (15.019 and 17.632) followed by number of floret per panicle (10.285 and 11.122). High heritability was observed for most of the characters under study viz. Days to 50% flowering, plant height, number of panicles per plant, panicle eight, panicle length, number of primary branches per panicle, number of secondary ranches per panicle, number of florets per panicle, number of grains per panicle, 1000 grain weight, grain length, grain breadth, grain L/B ratio, kernel length, kernel breadth, kernel L/B ratio and harvest index. High heritability coupled with high GA% was observed for panicle weight and number of floret per panicle. These characters are governed by additive gene action and one should go for direct selection for these traits. Key words: RILs, gcv, pcv, heritability, genetic advance.

NUTRITIONAL QUALITY AND HEATH POTENTIAL OF BUCKWHEAT (*FAGOPYRUM ESCULENTUM* MOENCH): A REVIEW

AMIT SINGH RANA¹, DHEERAJ BHATT², NIDHI JOSHI³, K. C VERMA⁴

DEPARTMENT OF BIOCHEMISTRY, COLLEGE OF BASIC SCIENCES AND HUMANITIES, GBPUA&T, PANTNAGAR, DISTT. U.S. NAGAR, UTTARAKHAND

Buckwheat (Fagopyrum esculentum) is a dicot and a pseudocereal (any member of non- grass family used as cereal), with a short life cycle and rich in high nutrient content. Buckwheat comes with a lot of promise as substitute staple crop as it contains the essential requirements a staple crop must possess. It is rich in biochemicals like protein, well balanced amino acid, essential fats, important phenolic compounds like flavonoids, rutin, phytosterols, fagopyrins, fagopyritols, resistant starch, dietary fibre, lignans, vitamins, minerals and antioxidants, some biochemicals are present in a little better amount than its contemporaries. Buckwheat is reported to have antioxidant potential and considered a food of high functional value. Absence of gliadin and gluten in buckwheat is another plus point in utilizing buckwheat as a significant number of people are unable to process such compounds found inevitably in crops. The inherent properties of anti-oxidant and prophylactic characters make buckwheat an attractive crop for further research. Buckwheat cultivation area is one factor that the crop demerits from, as it is not grown in high number and considered as a non-profitable crop. In India, Himalayan states are home to much of the buckwheat production and manly found its use in various food preparations and home remedies for common problem like constipation. As a household remedy for anemic patients, buckwheat leaves are cooked in iron vessels and fed to patients. Dyes are prepared and used on textile fabric from the hull of the seed and its perisperm is used as fuel in producer gas plants. For renovation of low productive land buckwheat is useful as a green manure crop, as it grows well on such land in short time also providing improved soil texture and increased productivity of other crops also is used as a smother crop. Further research on buckwheat thus presents itself with an abundance of opportunities to improve, adapt and practice its cultivation in order to incorporate it in our daily diet to rejuvenate us with all the important as well as additional health benefits.

Key words: Protein, antioxidant, rutin

CLIMATE CHANGE, ITS IMPACT ON AGRICULTURE AND MITIGATION STRATEGIES

DIPTI PARMAR, THAKAR CHIRAG, JOSHI NIKUNJ

DEPARTMENT OF VEGETABLE SCIENCE, COLLEGE OF HORTICULTURE, SARDARKRUSHINAGAR DANTIWADA AGRICULTURAL UNIVERSITY, JAGUDAN, MEHSANA-384460

Population growth and climate change are the challenges of the 21st Century. Climate change is mainly caused by anthropogenic emissions of greenhouse gases (GHG: CO_2 , CH₄, N₂O, HFC, PFC and SF₆), which accumulate in the earth's atmosphere and trap heat. It is a known fact that global temperature levels will rise anywhere between 2 - 5° over the next century. In developing countries like India, climate change could represent an additional stress on ecological and socio-economic systems that are already facing tremendous pressures due to rapid urbanization, industrialization and economic development. Climate change has had an effect on the monsoons too. India is heavily dependent on the monsoon to meet its agricultural and water needs, and also for protecting and propagating its rich biodiversity. Most of the simulation studies have shown a decreased in the duration and yield of crops as temperature increased in different parts of the India. Yields of both *kharif* and *rabi* crops decreased as temperature increased by 2°C; and increase resulted in 15-17 percent decrease in the grain yield of both crops, but beyond that the decrease was very high in wheat. The impacts of warming scenarios will become apparent at higher levels of fertilizer application from 2030 onwards. The nutritional quality of cereals and pulses may also be moderately affected which in turn will have consequences for our nutritional security. The loss in farm level net revenue may range between 9 per cent and 25 per cent for a temperature rise of 2-3.5°C climate change. The potential of organic agriculture in mitigating climate change depends on its ability to reduce emissions of GHGs, nitrous oxide and methane, increase soil carbon sequestration, and enhance effects of organic farming practices

which favour the above two processes. Reduction of greenhouse gas emissions recent experiments results suggested that organic agriculture can significantly reduce GHG emissions. Both conventional and organic agriculture relies on solar and fossil energy for food production. Carbon sequestration in soils and plants is the only strategy that can remove carbon from the atmosphere and, over time, reduce atmospheric concentration of CO₂. This approach allows the enforcement of adopting new and improved farming practices aim at mitigating climate change. In addition, organic agriculture is highly adaptable to climate change and is also provides a high degree of diversity in the ecosystem.

CROP GROWTH RATE (CGR) AND RELATIVE GROWTH RATE (RGR) OF *KALMEGH* [ANDROGRAPHIS PANICULATA (BURM. F.) WALL. EX NEES] AS INFLUENCED BY INTEGRATED APPLICATION OF ORGANIC MANURES AND FERTILITY LEVELS IN *TARAI* CONDITIONS OF UTTARAKHAND

HIMANSHU VERMA, M. S. NEGI AND B. S. MAHAPATRA DEPARTMENT OF AGRONOMY, COLLEGE OF AGRICULTURE, GBPUA&T, PANTNAGAR, UDHAM SINGH NAGAR 263145, UTTARAKHAND

A field experiment was conducted during kharif seasons of 2017-18 and 2018-19 at Medicinal Plants Research & Development Centre (M. R. D. C) of the G. B. Pant University of Agriculture & Technology, Pantnagar, District Udham Singh Nagar (Uttarakhand) to study the effect of organic manures and fertility levels on crop growth rate (CGR) and relative growth rate (RGR) of the kalmegh [Andrographis paniculata (Burm. f.) Wall. ex Nees]. The soil of the experimental site was sandy clay loam in texture having high organic carbon, low available nitrogen, high available phosphorus and medium in exchangeable potassium with slightly alkaline in reaction. The experiment was laid out in split plot design with three levels of organic manure and four fertility levels replicated thrice. The organic manures [no organic manure (control), vermicompost @ 5 t/ha and poultry manure @ 5 t/ha] were taken in main plots while the fertility levels [0: 50: 50, 50: 50, 75: 50: 50 and 75 (37.5 + 37.5): 50: 50 kg N, P₂O₅ and K₂O per hectare] were taken in the sub plots. Application of the organic manures and fertility levels influenced the crop growth rate and relative growth rates of the crop significantly during both the years of experimentation. Significantly higher CGR and RGR were recorded with application of vermicompost @ 5 t/ha (M2) followed by poultry manure @ 5 t/ha (M₃). Lesser rates were recorded where no organic manure was applied. Among fertility levels, significantly more crop growth rate (CGR) and relative growth rate (RGR) was recorded in the plots treated with application of 75 kg N/ha in two splits (F₃) followed by basal application of 75 kg N/ha (F4), 50 kg N/ha (F2) and 0 Kg N/ha (F1) at all the stages of crop growth during both the years. On the basis of the two years study, it can be concluded that 5 t/ha of vermicompost and 75 kg N/ha in two splits (37.5 kg as basal + 37.5 kg as top dressing at 25 days after transplanting), 50 kg P₂O₅ and 50 kg K₂O per hectare shall be applied for getting higher crop growth rate and relative growth rates.

CHARACTER ASSOCIATION FOR YIELD AND ITS CONTRIBUTING TRAITS IN URDBEAN (VIGNA MUNGO (L.) HEPPER)

V N PATHAK

DEPTT. GENETIC AND PLANT BREEDING, S M M TOWN P G COLLEGE, BALLIA

A field experiment was conducted to study the character association for 11 yield and its contributing traits on the 140 diverse genotypes of urdbean including three cheaks under augmented desion. The genotype UH - 55 produced highest seed yield per plant and significantly out yielded the remaing 139 genotypes. Seed yield per plant showed very strong and positive association with pods per plant, clusters per plant, biological yield per plant, primary branches per plant, 100 – seed weight, pods per cluster, plant height, seed per pod and days to 50% flowering. Most of the characters showing significant positive correlation with seed yield per plant. Harvest index had non-significant correlation with seed yield but it was negatively correlated with characters contribution towards greater vegetative partition. Pods per plants, followed by biological yield per plant, seed per pod, 100-seed weight and harvest index as major direct contribute or towards expression of seed yield per plant. Hence for the development of high traits possessing highly significant positive association should be given more weightage age in breeding or selection program.

Key words: Character Association in urdbean (Vigna mungo.)

NATURAL RESOURCE MANAGEMENT, FOOD AND ENVIRONMENT SECURITY FORMULATION OF NANOPARTICLES THROUGH AGROWASTE

RAJVEER SINGH¹, MANOJ KUMAR CHITARA², RAJEEW SHUKLA¹ ¹DEPARTMENT OF AGRONOMY, COA, GBPUA&T, PANTNAGAR ²DEPARTMENT OF PLANT PATHOLOGY, COA, GBPUA&T, PANTNAGAR

Agriculture contributes a large share to the GDP of our country nearly 17.3 percent. However, it generated million tonnes of agro-waste every year in India and globally. This includes crop waste, food processing waste, animal waste and also hazardous and toxic waste like pesticides insecticides, herbicides etc. Although there are technologies utilizing this waste to generate energy, the organic waste coming from agriculture remains a challenge, researchers and investigators need to focus on more and more ways to reduce this waste and derive direct and indirect benefits from it for a sustainable growth. Anyhow one of the solutions to this giant pile of problem may be answered by nanotechnology. In recent years nanotechnology has reached nearly every sector of science ranging from medical, industrial, agricultural, and even house old utilities. And have massively facilitated in evolution of existing technologies. Nanotechnology refers to a field of science where materials ranging from the size of 1 to 100 nm are dealt with. Nature comprises of many biotic species like plants, algae, fungi, yeast, etc. which are composed of biomolecules. They take part in the formation of nanoparticles with distinct shapes and sizes thereby acting as a driving force for the biosynthesis of nanoparticles with an environmentally benign process. The use of waste materials not only reduces the cost of synthesis but also minimizes energy requirement in comparison to physical or chemical synthesis methods, the need of using harmful chemicals or byproducts, and stimulates 'green synthesis'. Implement of Agro-waste would be unquestionably a strong step towards sustainable development. The nanotechnology seeks its application in all most all area of science and technology,

agriculture is no exception to that, yet a lot of development in the field has to happen for establishment of nanotechnology in agro industrial sector as agriculture is known as the back bone of our economy.

 ${\bf Keyword-} A gro \ waste, \ nanotechnology, \ green \ synthesis, \ nanoparticle.$

EFFECT OF OSMOTIC DEHYDRATION ON THE TEXTURAL AND MORPHOLOGICAL PROPERTIES OF SAND PEAR CANDY

POONAM AND PRADYUMAN KUMAR

DEPARTMENT OF FOOD ENGINEERING & TECHNOLOGY, SANT LONGOWAL ENGINEERING AND TECHNOLOGY, LONGOWAL, PUNJAB.-148106 (INDIA)

The pear is the pomaceous fruit belongs to the genus Pyrus in the family Rosaceae. The edible portion of fruit holds good amount of vitamin, minerals, carbohydrates, polyphenols and fiber. The fruit is also a good source of potassium. Pear fruit is a highly perishable commodity and can be preserved by canning and dehydration. The sand pear possesses attributes like grittiness, higher acidity and astringent taste and thus can be processed as candy. The pear candy can be prepared by combining the osmotic and convective dehydration at controlled conditions. In this study, various parameters describing the textural and morphological characteristics of fresh sand pear and sand pear candy were studied. Textural properties like hardness, cohesiveness, elasticity, adhesiveness, chewiness and gumminess were studied through textural profile analysis and morphological properties through scanning electron microscopy (SEM). The property of hardness is the major contributor affecting the overall acceptability of the product. This along with chewiness fully follows the estimated textural parameters. Results showed that sand pear candy possessed greater (1.61 to 2.51 Kgf) hardness as compared to fresh sand pear fruit. Cohesiveness, chewiness and gumminess of optimized sand pear candy followed reverse trend of hardness. Springiness (1.83 to 0.74%) and cohesiveness (0.019 to 0.009Kgf/sec) found to decrease in case of osmo-convectively dehydrated product. Various microstructural changes that occurred due to osmo-convective dehydration in the structure of sand pear were also examined. The main phenomena observed were shrinkage of cells, plasmolysis and folding of cell walls in the sand pear candy. Also, the pore sizes and the number of pores can influence the texture of food. Smaller number of pores and small sizes led to the dense structure, while larger number of pores and large pore size can cause a decrease of the hardness of the product. This is due to the reason that sand pear candy is harder than the fresh fruit because pore size becomes smaller due to the osmotic dehydration (OD) process followed by convective drying. Key words: Osmotic-dehydration, Sand Pear, Textural, Morphology, SEM, Candy

GENETIC PARAMETERS, CORRELATION AND PATH COEFFICIENT ANALYSIS FOR FODDER YIELD AND QUALITY IN FORAGE SORGHUM

HARSH DEEP¹, SATYAWAN ARYA², PUMMY KUMARI³, S. K. PAHUJA⁴ AND JAYANTI TOKAS⁵ ¹FORAGE SECTION, DEPT. OF GENETICS AND PLANT BREEDING, COLLEGE OF AGRICULTURE ² DEPT. OF BIOCHEMISTRY, COLLEGE OF BASIC SCIENCES AND HUMANITIES CHAUDHARY CHARAN SINGH HARYANA AGRICULTURAL UNIVERSITY, HISAR, HARYANA

The present investigation was conducted during the *Kharif* season of 2017 using 73 forage sorghum genotypes to obtain the knowledge about nature and magnitude of genetic parameters and its utilization in development of superior varieties of sorghum. The genetic parameters studied were namely, genotypic and phenotypic coefficient of variation (GCV & PCV), heritability (h²) in broad sense and genetic advance. Analysis of association among fodder yield component and quality parameters was also carried out to establish an appropriate selection criteria for sorghum fodder yield improvement. Analysis of variance revealed the presence of considerable genetic variability in all the 18 parameters inspected in present experiment. The estimate of GCV and PCV was observed highest for dry fodder yield (45.21% & 47.06%, respectively) and lowest for days to 50 percent flowering (6.94% & 7.02%, respectively). High broad sense heritability coupled with high genetic advance was observed for traits namely, green fodder yield, dry fodder yield, number of tillers per plant, plant height, leaf breadth, stem diameter, leaf: stem ratio, number of leaves per plant, HCN content, copper content, crude protein, TSS content, zinc content, manganese content and iron content. Correlation and path coefficient analysis displayed that Green fodder yield is positively correlated with traits namely, plant height, leaf length, number of leaves per plant, dry fodder yield and TSS content, whereas negatively correlated with leaf: stem, HCN, Zinc and manganese. Green fodder yield, exhibited the highest magnitude of direct effects on dry fodder yield, followed by number of leaves per plant, leaf breadth.

Key words: Forage sorghum, Genetic Parameters, GCV, PCV, Heritability, Genetic advance, Correlation, Path analysis

EFFECT OF DIFFERENT FEED SUPPLEMENTS ON INTESTINAL MORPHOLOGY AND IMMUNO-MODULATORY PARAMETERS IN BROILER CHICKENS

S. S. CHAUHAN, R. K. SHARMA, D. V. SINGH, S. K. SHUKLA, J. PALOD AND ANIL KUMAR DEPARTMENT OF LIVESTOCK PRODUCTION MANAGEMENT, GBPUA&T, PANTNAGAR, UTTARAKHAND-263145, INDIA

A feeding trial was conducted to study the effects of various feed supplements on intestinal morphology, haematological parameters, differential leucocyte count, serum biochemical parameters, serum mineral profile, immuno-modulatory parameters and faecal pathogens. Two hundred fifty two (252) day-old Cobb broiler chicks were randomly distributed into seven groups with 3 replicates of 12 chicks each. The first treatment was designated as control (T_0) in which no supplement was added to the feed, while in treatments T_1 ; organic mineral mixture (Organomin forte), T_2 ; organic mineral mixture (Vannamin), T_3 ; probiotics (Microguard), T_4 ; enzyme (Brozyme -XPR) and probiotics, T_5 ; emulsifier (Lipigon) were provided through feed. In T_6 group, 3 per cent less energy was given through feed. The results of the trial indicated that there was a significant increase in the length of duodenum, jejunum, ileum, small intestine, villus height and villus height: crypt depth ratio in broilers of supplemented groups. Significant increase in RBC, Hb, PCV, TLC and DLC was observed in supplemented groups. There was a significant decrease in serum glucose, total cholesterol, LDL- cholesterol and triglyceride levels while significant increase in HDL- cholesterol was seen. There was a significant increase in serum Ca and P while non significant effect on
sodium and potassium in feed supplemented groups was observed. There was a significant increase in total protein, albumin and globulin in feed supplemented groups. There was a significant increase in serum IgG while significant decrease in cortisol level in feed supplemented groups. Faecal pathogens (*E. coli* and *Salmonella enteridis*) were absent in all the groups. Thus, it may be concluded that dietary supplementation of basal diet with probiotics, enzymes and emulsifier is beneficial for poultry farmers. However, there is no advantage of resorting to 3% energy deprivation in birds.

Key words: Broilers, haematological parameters, intestinal morphology, feed supplements

SPECIES DIVERSITY AND REGENERATION OF BANJ OAK (*QUERCUS LEUCOTRICOPHORA* A. CAMUS.) DOMINATED FORESTS IN DWARAHAT BLOCK OF ALMORA DISTRICT OF UTTARAKHAND AMRITA BISHT AND NEELU LODHIYAL

DEPARTMENT OF BOTANY, D.S.B. CAMPUS, KUMAUN UNIVERSITY, NAINITAL-263002, UK

The present study was carried out to assess the diversity and regeneration pattern of *Quercus leucotricophora* A. Camus. dominated forests in Dwarahat block of Almora district during the year 2018-2019. Three forest were investigated i.e. Oak dominated Rhododendron mixed forest, Oak forest and Oak dominated Deodar mixed forest in Dwarahat block. Selected sites were in forest of Vijaypur, Aina, Nayal villages in Dwarahat block of Almora district. Vegetation analysis of trees, saplings and seedlings was done by placing random quadrats of 10×10 m size. For vegetation analysis of shrubs quadrats of 5×5 m size was placed and for herbs quadrats of 1×1 m was placed. The data was analysed for frequency, density, abundance, relative frequency, relative density and relative basal area represented as Importance Value Index (IVI) for the various species and for the forest sites. Tree, sapling and seedling density was recorded 445-480, 535-760 and 305-680 ind ha⁻¹ respectively. Shrub density for different sites ranged from 1280-4860 ind ha⁻¹ respectively. Herb density for different sites ranged from 1.546-2.54 respectively. Regeneration of *Quercus leucotricophora* was reported good in site 1 and 3, while in forest site 2 regeneration of *Quercus leucotricophora* was reported poor. The poor regeneration status of species in the studied forest site indicates the impact of anthropogenic disturbances. Thus, the above findings of *Quercus leucotricophora* have shown that there is an urgent need to provide judicious inputs of management and conservation for sustaining the oak species in such forest sites of the region.

Key words: Quercus leucotricophora, species diversity, trees, saplings, seedlings, regeneration.

STUDY OF GENETIC DIVERSITY IN NIGER

SHUBHANGI G. PATIL

DEPARTMENT OF AGRICULTURAL BOTANY, COLLEGE OF AGRICULTURE DHULE-424 004 (MPKV), (M.S.), INDIA.

The present investigation entitled "Study of Genetic Diversity in Niger" was undertaken during Kharif 2018. The experiment was carried out in Randomized block Design (RBD) with two replications to know the amount of genetic divergence in 45 germplasm of Niger. An experiment was undertaken by utilizing forty five niger genotypes for twelve yield and yield contributing characters to assess genetic diversity. The analysis of variance has shown that there was significant variation among the genotypes in all the traits. The multivariate analysis carried out using Mahalanobis D²-statistics, indicated wider genetic diversity in the genotypes of niger. Out of ten cluster formed, cluster III was largest with twelve genotypes, followed by cluster I with eleven genotypes, cluster II and V with six genotypes, cluster VIII with five and IV, VI, VII, IX, X were mono-genotypic. The clustering pattern indicated absence of relationship between genetic diversity and geographical origin of the genotypes. The maximum inter cluster distance was observed between cluster II and X (D^2 = 16.87) while, lowest divergence was noticed between cluster VII and X (D²=4.11). Maximum intra cluster distance observed within cluster V (D²=6.76) while lowest intra cluster distance was observed within cluster I (D²=5.16). The variance for cluster means were high for number of seeds per capitula (29.70), followed by number of secondary branches per plant (16.26), number of primary branches per plant (13.54), 1000 seed weight (12.53), number of capitula per plant (12.32) and was low for plant height, days to maturity, diameter of capitula, protein content, seed yield per plant, oil content, days to 50 % flowering. Based on inter-cluster distances, cluster mean and per se performance, and divergence class the genotypes viz., DHLN-17, DHLN-18, DHLN-26, DHLN-29, DHLN-39, DHLN-41, DHLN-42, DHLN-44 were distinct and diverse and can be classified as promising genotypes. These seven genotypes can be used for inter-crossing to obtain heterosis and also wider variability in niger. Hybridization between the genotypes of cluster II with the genotypes of cluster X may result in exploiting more heterosis with maximum genetic divergence and are likely to produce desirable transgressive segregants in segregating generations for further crop improvement.

Key words: Genetic diversity, D² value, cluster, genotype

TIME SERIES ANALYSIS MODEL TO FORECAST RAINFALL FOR JAGDALPUR REGION (CHHATTISGARH) AVINASH YADU, ANOSH GRAHAM, AND JYOTISH KUMAR SAHU DEPARTMENT OF ENVIRONMENT SCIENCES & NRM, COLLEGE OF FORESTRY

SAM HIGGINBOTTOM UNIVERSITY OF AGRICULTURE TECHNOLOGY AND SCIENCES, ALLAHABAD

The present study investigates the Time series analysis model to forecast rainfall for Jagdalpur region Chhattisgarh. The prediction of Rainfall on monthly and seasonal time scales is not only scientifically Challenging but is also important for planning and devising agricultural strategies. Various research groups attempted to predict rainfall on a seasonal time scales using different techniques. This paper describes the Box-Jenkins time series seasonal ARIMA (Auto Regression Integrated Moving Average) approach for prediction of rainfall on monthly scales. ARIMA model (0, 0, 0) (0, 1, 1) for rainfall was identified the best model to forecast rainfall for next 4 years with confidence level of 95 percent by analyzing last 27 year's data (1990-20016). Previous years data is used to formulate the seasonal ARIMA model and in determination of model parameters. The performance evaluations of the adopted models are carried out on the basis of correlation coefficient (R²) and root mean square error (RMSE). The study conducted at Jagdalpur, Chhattisgarh (India). The results indicate that the ARIMA model provide consistent and satisfactory predictions for rainfall parameters on monthly scale. **Keywords**: Rainfall, ARIMA, correlation coefficient (R²), root mean square error (RMSE)

VERTICAL FARMING: THE FUTURE OF AGRICULTURE

MANISH KUMAR

DEPARTMENT OF HORTICULTURE, MAHARANA PRATAP HORTICULTURAL UNIVERSITY, KARNAL

By 2050, the world's population is expected to grow by another 2 billion people, and feeding it will be a huge challenge. Due to industrial development and urbanization, we are losing arable lands every day Vertical farms have the potential to reduce or eliminate the need to create additional farmland .Vertical farming is the practice of producing food in vertically stacked layers, vertically inclined surfaces and/or integrated in other structures (such as in a skyscraper, used warehouse, or shipping container). The modern ideas of vertical farming use indoor farming techniques and controlled-environment agriculture (CEA) technology, where many environmental factors can be controlled. These facilities utilize artificial control of light, environmental control (humidity, temperature, gases etc.) and fertigation. The primary goal of vertical farming is maximizing crops output in a limited space. The working of vertical farms based on 4 critical areas mainly - Physical layout (stalked layers), Lighting (natural and artificial lights), Soil less Growing medium (hydroponics, aeroponics, peat moss, coco peat) and sustainability features to offset the energy cost of farming. Having greater output from a small cultivation area is not the only advantage of vertical farming. There are many more advantages such as it offers a plan to handle future food demands .It allows crops to grow year-round. It uses significantly less water. Weather doesn't affect the crops. More organic crops can be grown. There is less exposure to chemicals and disease

Keywords: Agriculture, Controlled Environment, Future, Vertical Farming

BIO-EFFICACY OF STROBILURIN, TRIAZOLE AND PROPYLENE BIS-DITHIOCARBAMATE FUNGICIDES AGAINST *MACROPHOMINA PHASEOLINA* (TASSI) GOID

PRABHU NARAYAN MEENA[‡], SUBRATA SATPATHY, SABYASACHI MITRA ICAR-CENTRAL RESEARCH INSTITUTE FOR JUTE AND ALLIED FIBRES, BARRACKPORE, KOLKATA

Stem rot and root rot diseases of jute caused by *Macrophomina phaseolina* (Tassi) Goid persists throughout the crop growth period and incurs substantial fiber yield losses of jute crop across the India and worldwide. The main aim of this study was to find out the potentiality of eight systemic and broad spectrum fungicides (Azoxystrobin (strobilurin), Carbendazim (benzimidazole), Difenconazole, Tebuconazole, Propiconazole, Cyproconazole, Tricyclazole (triazole) and Propineb (propylene bis-dithiocarbamate), used either alone or with combination as seed treatment (ST) and foliar sprays (FS) to control the *Macrophomina phaseolina*. Duncan's multiple range test was used to determine significant difference (p<0.05) between the treatments. The treatment consisting with Azoxystrobin 18.2% SC + Difenconazole 11.4% SC @ 1.0 ml kg⁻¹ seed (ST) + Azoxystrobin + Difenconazole @ 0.075% (FS) at 45 days of crop age followed by treatment with Tebuconazole 2DS (ST) @ 1.5 g kg⁻¹ seed + Tebuconazole @ 0.15% (FS) at 45 days of crop age proved more effective in management of stem rot and root rot diseases of jute and exhibited better fibre yield over untreated control. These treatment modules can be used as a component in Integrated Disease Management (IDM).

Keywords: Jute, Stem rot, Root rot, M. phaseolina, Fungicides, Management

CLIMATE VARIABILITY AND CHANGE: PROJECTIONS, IMPACTS AND INTERVENTIONS FOR AGRO ECO-SYSTEMS NEELAM KUMARI AND PANKAJ YADAV

DEPARTMENT OF EXTENSION EDUCATION CCS HARYANA AGRICULTURAL UNIVERSITY HISAR 125004 DEPARTMENT OF HORTICULTURE, MAHARANA PRATAP HORTICULTURAL UNIVERSITY, KARNAL

Climate is an important environmental influence on ecosystems. Changing climate affects ecosystems in a variety of ways. For instance, warming may force species to migrate to higher latitudes or higher elevations where temperatures are more conducive to their survival. Similarly, as sea level rises, saltwater intrusion into a freshwater system may force some key species to relocate or die, thus removing predators or prey that are critical in the existing food chain. Climate change not only affects ecosystems and species directly, it also interacts with other human stressors such as development. Although some stressors cause only minor impacts when acting alone, their cumulative impact may lead to dramatic ecological changes. As we have seen, climate variability describes short-term changes in climate that take place over months, seasons and years. This variability is the result of natural, large-scale features of the climate that we looked at earlier. It is likely that you have heard of El Nino and La Nina, these are the two phases of the El Nino-Southern Oscillation (sometimes shortened to ENSO) which is the most important driver of year-to-year variability in climate in the Pacific region. Consequently, even when changes in extremes can be documented, unless a specific analysis has been completed, it is often uncertain whether the changes are caused by a change in the mean, variance, or both. In addition, uncertainties in the rate of change of the mean confound interpretation of changes in variance since all variance statistics are dependent on a reference level, i.e., the mean. For variables that are not well approximated by normal distributions, like precipitation, the situation is even more complex, especially for dry climates. . There is no substitute for dramatic reductions in greenhouse gas emissions to mitigate the negative consequences of climate change, together with adaptation of human and natural systems to make them more resilient to changing climate.

Keywords: Climate, Ecosystem, Environment, Variability, income

ALTERNATIVE TO ANTIBIOTIC RESISTANCE MARKER GENE PRITI KUMARI

DEPARTMENT OF PLANT BREEDING & GENETICS, BIHAR AGRICULTURAL UNIVERSITY, SABOUR-813210

Antibiotic resistance is the ability of a microorganism to withstand the effects of an antibiotic. It is a specific type of drug resistance and evolves naturally via natural selection through random mutation, but it could also be engineered by applying an evolutionary stress on a population. Several studies have demonstrated that patterns of antibiotic usage greatly affect the number of resistant organisms which develop. Overuse of broad-spectrum antibiotics, such as second- and third-generation cephalosporins, greatly hastens the development of methicillin resistance. Genes conferring resistance to antibiotics have been widely used as markers for the selection of transformed cells in the development of genetically modified (GM) plants. Their presence in GM plants released in the environment or used as food or feed has

raised concerns over the past years regarding possible risks for human health and the environment There are some selection approaches have been pursued to alternate the use of antibiotic resistance marker genes.

AMELIORATING POTENCY OF VITAMIN E ON HEMATOLOGICAL PARAMETERS AGAINST TOXICITY INDUCED BY HEXAVALENT CHROMIUM IN LABORATORY CHICKS

VANDITA KANDPAL AND DHARMENDRA KUMAR*

DEPARTMENT OF ZOOLOGY, S. V. GOVT. P. G. COLLEGE, LOHAGHAT (CHAMPAWAT), UTTARAKHAND, INDIA.

The determination of blood components by laboratory tests is an important procedure to assist the diagnosis of various poultry diseases and disorders. Considering the importance of this subject, present study has been carried out to evaluate the protective effect of vitamin E as an antioxidant against toxicity induced by chromium in the form of potassium dichromate (K2Cr2O7), on hematological parameters (RBC, WBC, Hb, PCV and MCHC) in laboratory chicks (Gallus gallus domesticus).

Hypothesis -- Vitamin E act as an antioxidant against toxicity induced by different heavy metals. To prove this fact we have decided to study on protective effects of vitamin E against hexavalent Cr toxicity on various hematological parameters. However, to strengthen this work, further studies are required to clarify the preventive role of vitamin E against hexavalent chromium induced toxicity in chicks. Experiment was conducted in randomly divided three equal groups (n = 3) of chicks. Chicks of group A were administered with sublethal dose of potassium dichromate (K₂Cr₂O₇) (5 mg/100 gm body weight) by gavage on each alternate day for 30 days. Chicks of group B were treated with potassium dichromate (K₂Cr₂O₇), but also administered with vitamin-E (intramuscularly) (0.5 IU/100 gm body weight) on each alternate day for 30 days. Chicks of Group C were administered with saline only to serve as control. Blood samples were collected from cardiac puncture and transferred to the laboratory for measuring the haematological parameters: RBC, WBC, Hb, PCV and MCHC. Significant (p<0.05) decrease in hematological values were observed in purely Cr treated group. However, these values were significantly increase in vitamin E administered chicks as compared to Cr treated chicks up to normal control level. It may be concluded that the progressive toxic effect of hexavalent chromium on hematological values, can be moderately reduced by supplying vitamin E in Gallus gallus domesticus.

Key words: Chromium, Vitamin E, Heavy metals, Hematological parameters.

LABORATORY STUDY ON THE EFFECT OF SOME PLANT PROTECTION CHEMICALS AGAINST BEAUVERIA BASSIANA.

RAM PRAWESH. PRASAD*1, MANOJ.S. PAUL ¹ AND SUDHIR KUMAR SINGH ²

1.DEPARTMENT OF PLANT PATHOLOGY & NEMATOLOGY, SAM HIGGINBOTTOM UNIVERSITY OF AGRICULTURE, TECHNOLOGY AND SCIENCES, NAINI, PRAYAGRAJ, 211007, UTTAR PRADESH

2.DEPARTMENT OF AGRONOMY, SAM HIGGINBOTTOM UNIVERSITY OF AGRICULTURE, TECHNOLOGY AND SCIENCES, NAINI, PRAYAGRAJ, 211007, UTTAR PRADESH, INDIA

Usually farmers in India are unaware of biological control agent and their possible application in the field of controlling pests in agriculture. They have been using many synthetic pesticides such as Demerom, Monocrotophos, Malathion, Profeniphose, Dimethoate etc. for controlling pests. Evidence of chemical pesticides poisoning in human and wild life contamination of ecosystem, high level of pesticides in food articles are becoming increasingly of great concern. IPM in management of soil borne insect pests should aim at combining all principles of pest management including bio-control agent. Among the various autogonistic micro-organism used as biocontrol agent against pest control, white muscardine fungus Beauveria bassiana is well known for its potential as on effective bio-pesticide. Therefore, there is urgent need to study the compatibility of this fungus with commonly used Agro-chemicals pesticides before recommending its application against the pest. The experiment was conducted in the laboratory of Plant Pathology and Nematology deptt, to laboratory study on the effect of some plant protection chemicals against Beauveria bassiana. The experiment was laid out in the completely random design (CRD) with eight pesticides namely weedicides- 2-4 D, butachlor, fungicides- vitavax, capton, nematicidesphorate 10 G, cabofuran and insecticides- malathion & endosulphon by keeping four concentration 1,10,100 and 1000 PPM with four replication and over the control. The effect of "Poisoned Food Technique" was study on growth of Beauveria bassiana on soubouraud dextrose agar (SDA) medium and soubouraud dextrose(SD) broth medium were maintained for each treatment including control. The radial growth of fungal colony in SDA medium was taken seven days and the mycelium weight of fungus is SD broth medium was taken after fifteen days. All the pesticides generally inhibit the fungal growth at all the four concentration on the both medium. There was the direct relationship between increased the chemicals concentration and inhibit the fungal growth. Key words: Beauveria bassiana, Plant protection chemicals, Poisoned food technique.

COMPARISONS OF QUANTITY AND QUALITY OF LIPIDS FOR TWO STRAINS OF CHLORELLA VULGARIS AND THEIR EVALUATION FOR BIODIESEL PRODUCTION

RAJNI CHAUDHARY1, J.I.S KHATTAR²

1DEPARTMENT OF AGRICULTURE, BABA FARID COLLEGE, DEON (BATHINDA), INDIA 2DEPARTMENT OF BOTANY, PUNJABI UNIVERSITY, PATIALA, INDIA

Renewable energy sources are the focus of this century. Economically and environmental friendly production of such energies are the challenges that limit their usages. Microalgae is one of the most promising renewable feedstocks. The objective of this work was to study the growth, lipid production and lipid profile of two different strains of Chlorella vulgaris BNL54, FKN45 an isolates from Punjab and Kedarnath, India respectively, under optimized culture conditions. Under N limitation, biomass production of both isolates decreased by 5% and the amount of lipids increased by 11% in C. vulgaris BNL54 and 9 % FKN45over control cultures. In C. vulgaris BNL54 under continuous illumination biomass increased by 7% while lipid content increased by 10%. The optimised condition for C. vulgaris FKN51 was pH 8.4 where the biomass and lipid content increased by 5% and 8% respectively. The fatty acid profile of lipids of the organism under optimized conditions also changed. Under continuous illumination C. vulgaris BNL54 showed saturated fatty acid (SFA) content were 69 %, monounsaturated fatty (MUFA) were 14% and polyunsaturated fatty acids (PUFA) were 16%; compared to control cultures with 42%

SFA, 27% MUFA and 30% PUFA. While *C. vulgaris* FKN51 saturated fatty acid (SFA) content were 54 %, monounsaturated fatty (MUFA) were 26% and polyunsaturated fatty acids (PUFA) were 20% compared to control cultures with 39.3% SFA, 33% MUFA and 27.7% PUFA in medium with pH 8.4. This indicated fatty acid profile of lipids of both strains under optimized conditions were better from biodiesel production point of view.

Keywords: Biofuel, Biodiesel, Energy, Environment, Microalgae, Renewable energy

EFFECT OF CLIMATIC FACTORS ON BIO-ECOLOGY OF LEAF MINER OF CASHEW FOR SUSTAINABLE PRODUCTION OF CASHEW IN CHHATTISGARH

<u>K. R. SAHU</u>^{*}, D. SHARMA AND B. P. KATLAM INDIRA GANDHI KRISHI VISHWAVIDHYALAYA, S. G. COLLEGE OF AGRICULTURE AND RESEARCH STATION, JAGDALPUR– 494 005 (C. G.)

The Cashew (*Anacardium occidentale* L.) has now gained special status in the international scenario as a plantation crop of considerable foreign exchange earning. India entered into international cashew trade a century ago and continues to be in supreme position even today. Chhattisgarh has large wasteland area suitable for cashew cultivation mostly in the districts of Bastar and Raigarh. There are various factors responsible for low yield in cashew, in which the insect pest problem is major one. Cashew crop is attacked by more than 180 species of insect and non- insect pests in India (Sundaraju, 1993). The cashew leaf miner (*Acrocercops syngramma* M.) (Lepidoptera: Gracillariidae) is a major pest causing serious damage to the tender foliage of post monsoon flushes. Abraham (1958) estimated the damage of leaf miner to be 26 per cent in severely infested tracts. To study the effect of climatic factors on bio-ecology of leaf miner a survey conducted at S.G. College Of Agriculture & Research Station, IGKV, Jagdalpur (C.G.) during 2004-05 and 2005-06 in randomly selected trees in cashew plantation in the surrounding areas of Bastar (Chhattisgarh) and their intensities in forest plantation were recorded at weekly intervals 1.0 sq. m area on the tree canopy on all the four sides. In 2004-05, the incidence of leaf miner was observed throughout the year, the leaf damage ranged from 0.90 to 15.51 percent with relatively high incidence during December month. In 2005-06, the incidence of leaf miner damage was observed throughout the year, the leaf damage ranged from 0.0 to 46.48 percent with relatively high incidence during November month. The multiple regression analysis of climatic factors with the bio-ecology of leaf miner indicated that maximum temperature negatively contributed 35% towards incidence of leaf miner. The evening RH also contributed 35% towards leaf miner incidence.

Key words: Cashew insects, Acrocercops syngramma, climatic factors

EFFECT OF INCORPORATION OF BEETROOT POWDER ON THE TEXTURAL PROPERTIES AND SHELF LIFE OF NUTRITIOUS SNACK BAR

PRIYANKA TANGARIYA AND PRATIMA AWASTHI

DEPARTMENT OF FOODS AND NUTRITION, GOVIND BALLABH PANT UNIVERSITY OF AGRICULTURE AND TECHNOLOGY, PANTNAGAR, UDHAM SINGH NAGAR, UTTARAKHAND

Since the past decade, World Health Organization recommends formulation of innovative food products that represent healthy choices for consumers (WHO, 2004). Snack bars are such nutritious foods; usually prepared with cereals, millets, pulses, various fruits and sweeteners. However, utilization of nutrient dense horticultural vegetables is still uncommon in preparation of snack bars. Therefore, the objective of this study was preparation, textural evaluation of beetroot incorporated snack bars and shelf life assessment of snack bars selected on the basis of textural properties. For preparation of snack bars raw materials namely; beetroot powder, bengal gram, flax seeds, sesame seeds, coconut chips, peanuts and honey were used in different proportions. Thereafter, textural properties of all the bars were analyzed using HDTA texture analyzer. Based on texture analysis, one control and one beetroot snack bar, were selected followed by their storage study. Storage study was carried out for 90 days at refrigeration (5°C) and ambient temperature (15-35°C). Various sensory parameters using sensory score card method (Amerine *et al.* 1965) and parameters namely; moisture, free fatty acid (AOAC, 2000), total plate count and yeast and mould count (APHA, 1992) were analyzed under storage study. Texture analysis revealed that hardness, gumminess and chewiness decreased with increase in the level of beetroot powder and honey, however cohesiveness and springiness increased in all the bars. A₃ control bar and beetroot powder incorporated bar D₃, were selected for storage study. An increase in the moisture and free fatty acid content was observed. Total Plate Count (TPC) and yeast and mold count also increased throughout storage period but within the acceptable limit. Therefore, it may be concluded that incorporation of beetroot powder attributed the characteristic texture properties in snack bars. Beetroot powder was also found as the key ingredient that improved the shelf life of bar.

Key words: texture, shelf life, beetroot powder, sensory parameters

SELECTION OF PARENTS BASED ON COMBINING ABILITY STUDIES IN OKRA (ABELMOSCHUS ESCULENTUS L. MOENCH)

AMBA KUMARI*1, VIJAY KUMAR SINGH1, R.P PRASAD2, CHANDAN KUMAR3

1. DEPARTMENT OF VEGETABLE SCIENCE, BIHAR AGRICULTURAL UNIVERSITY, SABOUR (BHAGALPUR) - 813210, BIHAR, INDIA

2. DEPARTMENT OF PLANT PROTECTION, KVK (DARBHANGA)-847302

3. DEPARTMENT OF PLANT BREEDING & GENETICS, RAU, PUSA (SAMASTIPUR) - 843121, BIHAR

Okra is an important from nutritional, medicinal point of view. It is valued for its medicinal properties to cure renal colic, leucorrhoea, chronic dysentery and goitre due to high iodine content in fruits. In okra, a large number of varieties have been developed but substantial increase in productivity could not be realized. There is a necessary to improve the yield per unit area to achieve the increased production from a limited land. In often cross-pollinated crops like okra, improvement in the past was based on selection in locally adapted populations. During recent past, exploitation of hybrid vigour and selection of parents on the basis of combining ability effects have opened a new line of approach in crop improvement. The study was conducted at the vegetable science Research Farm, Bihar Agricultural University, Sabour, Bhagalpur (Bihar) during 2016. The experiment was undertaken to study the combining ability for yield and its contributing traits in okra. The experimental material consisted of 30 genotype (7 parents, 2

standard checks and 21 F1 hybrids) was conducted in a randomized block design (RBD) for fifteen characters. The mean squares due to gca (General combining ability), sca(specific combining ability) effects were significant for pod yield and yield contributing traits studied. The parents Kashi Kranti, Arka Abhay and Pusa Sawani were found to be best general combiner for most of the characters including yield per plant and can be exploited well in further breeding programme. The estimates of sca effects revealed that the cross combination Arka Abhay x Kashi Kranti, Kashi Pragati x Pusa Sawani, Arka Abhay x Punjab Padmini,Punjab Padmini x Pusa sawani and Arka Anamika x Kashi Kranti exhibited positive significant effect for yield and yield attributing character and some of its related traits could be used as heterotic hybrids.

Key words- Abelmoschus esculentus L. Moench, Combining ability, gca effects, sca effects

THE EFFECT OF MAGNESIUM, SULPHUR, BORON AND ZINC AS FOLIAR APPLICATION ON THE QUALITY OF POTATO UNDER TERAI AGRO-CLIMATIC REGION OF WEST BENGAL

EGGADI RAMESH¹, J C JANA² AND SUBHAMOY SIKDER³.

UTTAR BANGA KRISHI VISWAVIDYALAYA, PUNDIBARI, COOCH BEHAR,WEST BENGAL, INDIA

The present investigation entitled, "The effect of magnesium, sulphur, boron and zinc as foliar application on the quality of potato under terai agro-climatic region of west bengal" was carried out at the Instructional Farm, Faculty of Horticulture of Uttar Banga Krishi Vishwavidyalaya, Pundibari, Cooch Behar during rabi season of 2017 - 2018. The experiment was laid out in Randomized Block Design with three replications comprising 16 treatments for foliar application of different sole and combined foliar application of magnesium, sulphur, boron and zinc *viz*, T₁- Mg, T₂-S, T₃-Zn, T₄-B, T₅-Mg and S, T₆-Mg and Zn, T₇-Mg and B, T₈-S and Zn, T₉-S and B, T₁₀-Zn and B, T₁₁- Mg, Zn and S, T₁₂-Mg, Zn and B, T₁₃-Mg, B and S, T₁₄-S, Zn and B, T₁₅-Mg, S, Zn and B and along with control(T₁₆) of no nutrients. In present investigation all the growth and yield parameters were improved significantly. The maximum total carbohydrate content of tubers was 46.25, highest starch content (per cent) of tubers was 18.78, total Reducing and total sugars of tubers were 0.32 and 0.79 was recorded with the foliar application of Magnesium (Mg), sulphur (S), zinc (Zn) and boron (B).

Key word: Magnesium (Mg), sulphur (S), zinc (Zn) and boron (B), foliar application, potato, quality.

ROLE OF BIOINFORMATICS IN FRUITS CROP IMPROVEMENT

RAVI KONDLE*, SARAD GURUNG

DEPARTMENT OF POMOLOGY AND POST HARVEST TECHNOLOGY, UTTAR BANGA KRISHI VISWAVIDYALAYA, PUNDIBARI, COOCHBEHAR-736165, WEST BENGAL, INDIA.

Bioinformatics is the field of science in which biology, computer science, and information technology merge to form a single discipline. The ultimate goal of bioinformatics is to make possible new biological insights and create a global perspective on the unifying principles in biology. Bioinformatics encompasses many tools and techniques that today are essential for all areas of research in the biological sciences. New databases with a wealth of information about genomes, proteins, metabolites, and metabolic pathways appear almost daily. Bioinformatics plays a significant role in the development of the horticultural sector, horti-based industries, horticultural by-products utilization and better management of the environment.

Role of Bioinformatics in fruit crops are Fruit breeding, Improve nutritional quality and Development of stress tolerant varieties. A genome program can now be envisioned as a highly important tool for fruit plant breeding. Identifying key genes and understanding their function will result in a "quantum leap" in fruit quality improvement. Additionally, the ability to examine gene expression will allow us to understand how fruit plants respond to and interact with the physical environment and management practices. This information, in conjunction with appropriate technology, may provide predictive measures of plant health and fruit quality and become part of future breeding decision management systems. Current genome programs generate a large amount of data that will require processing, storage and distribution to the international research community. Comparative genomics along with bioinformatics could help in achieving improvement of yields, nutrition and biotic stress in Grape, Strawberry, Sweet cherry, Citrus, Litchi, Apple, and Papaya. The ultimate goal of bioinformatics is to integrate large scale data for understanding the molecular mechanism involved in various developmental processes. This understanding can help in improvement of fruit crops.

Keywords: fruit plants, bioinformatics, genomics, nutritional quality, stress tolerant varieties.

EFFECT OF CLIMATICAL CONDITIONS ON MEDICINAL AND AROMATIC CROPS

ANJANEYULU*

DEPARTMENT OF PLANTATION, SPICES, MEDICINAL AND AROMATIC CROPS, BIDHAN CHANDRA KRISHI VISWAVIDYALAYA, MOHANPUR, NADIA, WEST BENGAL 741252.

Climate change and its variability are posing the major challenges influencing the performance of annual and perennial horticulture crops. Reduction in production of Vegetables, Medicinal and Aromatic crops is likely to be caused by short growing period, which will have negative impact on growth and development particularly due to terminal heat stress and decreased water availability. In different regions experience the kind of disasters like cyclone, heavy rain, drought, hailstorm, flood, frost, and other abiotic stresses which are explained as impact of climate change. Changes in weather patterns resulting in changing climate, has threatened agricultural productivity through high and low temperature regimes and increased rainfall variability. Issues of climate change will definitely pose a more prominent threat to MAP species than other threats; however, scientists do not know whether climate change has the potential to exert increasing pressures upon MAP species and populations. Climate change impact may have a tremendous possible effect on MAPs particularly significant due to their value within traditional systems of medicine and as economically useful plants. At this stage, the future effects of climate change are largely uncertain more so with MAPs, but current evidence suggests that these phenomena are having an impact on MAPs and that there are some potential threats worthy of concern and discussion.

Key words: A biotic stresses, Climate change, Disasters, Medicinal and Aromatic, Vegetables.

PRINCIPAL COMPONENT ANALYSIS FOR FODDER YIELD AND ITS RELATED TRAITS IN FORAGE SORGHUM [SORGHUM BICOLOR (L.) MOENCH]

HARSH DEEP¹, SATYAWAN ARYA², PUMMY KUMARI³, S. K. PAHUJA⁴ AND JAYANTI TOKAS⁵

¹FORAGE SECTION, DEPT. OF GENETICS AND PLANT BREEDING, COLLEGE OF AGRICULTURE

²DEPT. OF BIOCHEMISTRY, COLLEGE OF BASIC SCIENCES AND HUMANITIES

CHAUDHARY CHARAN SINGH HARYANA AGRICULTURAL UNIVERSITY, HISAR, HARYANA

The present investigation was conducted during the *Kharif* season of 2017 using 73 forage sorghum genotypes to obtain the knowledge about nature and magnitude of genetic parameters and its utilization in development of superior varieties of sorghum. The genetic parameters studied were namely, genotypic and phenotypic coefficient of variation (GCV & PCV), heritability (h^2) in broad sense and genetic advance. Analysis of variance revealed sufficient variability for all the 18 quantitative traits under study. The estimate of GCV and PCV was observed highest for dry fodder yield (45.21% & 47.06%, respectively) and lowest for days to 50 percent flowering (6.94% & 7.02%, respectively). High broad sense heritability coupled with high genetic advance was observed for traits namely, green fodder yield, dry fodder yield, number of tillers per plant, plant height, leaf breadth, stem diameter, leaf: stem ratio, number of leaves per plant, HCN content, copper content, crude protein, TSS content, zinc content, manganese content and iron content. The Mahalanobis D² analysis grouped 73 forage sorghum genotypes into seven clusters. The inter cluster distance was observed maximum between cluster IV and cluster VII. Principal component analysis transformed the original 18 interrelated variables into seven major principal components those explaining 69.79 per cent of total variation in the data. Correlation and path coefficient analysis displayed that Green fodder yield is positively correlated with leaf: stem, HCN, Zinc and manganese. Green fodder yield, exhibited the highest magnitude of direct effects on dry fodder yield, followed by number of leaves per plant, leaf length and leaf breadth.

Key words: Forage sorghum, Genetic Parameters, GCV, PCV, Heritability, Genetic advance, Correlation, Path analysis

STANDARDIZATION OF FERTILIZER IN PAPAYA (CARICA PAPAYA L.) FOR COMMERCIAL CULTIVATION UNDER BIHAR CONDITION

PUSHPA KUMARI¹, M FEZA AHMAD¹, MANOJ KUNDU¹, AK JHA², SANTOSH KUMAR¹

¹DEPARTMENT OF HORTICULTURE (FRUIT & FRUIT TECHNOLOGY), BIHAR AGRICULTURAL UNIVERSITY, SABOUR, BHAGALPUR, BIHAR, INDIA

²DEPARTMENT OF FOOD SCIENCE AND POSTHARVEST TECHNOLOGY, BIHAR AGRICULTURAL UNIVERSITY, SABOUR, BHAGALPUR, BIHAR, INDIA

Papaya (*Carica papaya* L.) is an important tropical fruit plant, belongs to the family Caricaceae. An experiment entitled "Standardization of fertilizer in papaya (*Carica papaya* L.) for commercial cultivation under Bihar condition" was conducted during the year 2016-17 at Horticulture garden, Bihar Agricultural University, Sabour, Bhagalpur (Bihar). Papaya cv. Red Lady selected for an experiment due to its gynodioecious nature. It is highly productive, dwarf and early bearing in nature. The experiment contains twenty seven treatment with three replication under Randomised Block Design (RBD factorial). In this treatment, three levels of each calcium nitrate, neem coated urea (both @ of 0, 100 & 200 g/plant) and muriate of potash (0, 200 & 400 g/plant) were taken and applied in four equal split starting at 2 month of planting. The results showed that, number of flowers and fruits/plant ranged from 19.19 - 20.89 and 14.97 - 18.14 respectively, fruit weight from 0.33 - 0.36%. Neem coated urea showed best result in increasing the no. of flowers and fruit weight than calcium nitrate. Whereas, higher dose (400 g/plant) of muriate of potash showed best result in increasing quality of papaya fruits. **Keywords**: Papaya, fertilizer, potash, nitrogen, quality

RELEASE AND POOLS OF PHOSPHORUS IN DIFFERENT SOILS AND ITS UTILIZATION EFFICIENCY BY CHICKPEA AS INFLUENCED BY DIFFERENT SOURCE OF ROCK PHOSPHATES AND ORGANICS NEETA MAHAWAR^{*} AND G. S. TAGORE

DEPARTMENT OF SOIL SCIENCE AND AGRICULTURAL CHEMISTRY, RVSKVV, GWALIOR, MP

An experiment was carried out in the laboratory of Department of Soil Science and Agricultural Chemistry, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur during 2018-19.Study based on hypotheses was assessed through incubation study in lab and pot experiment in glass house. In the first approach, soil samples were pre incubated at 25 °C for 1 week prior to actual incubation to stabilize the microbial activity. 100 g oven-dry soil on weight basis was taken, air dried, sieved with 2-mm sieve and transferred into 500 ml jars. The experiment consisted of three soils \$1.\$2 and \$3 and 3 Rock Phosphates (RP) of origin Jhabua, Udaipur-I, Udaipur-II assisting 11 treatments including the control and six incubation intervals (15, 30, 45, 60, 90 and 120 days). The incubation results indicated a positive impact of the organic acids and FYM with increasing days of incubation gaining highest peak at 60 days in their ability to release phosphorus from all the 3 Rock Phosphate's. 45 to 60 DAI (Days after incubation) were found most competent for phosphorus availability. URP II showed maximum available P with gluconic acid @20 mM (5.92 ppm) with an increase of 39% followed by FYM @5 tonne ha⁻¹ with available P (5.84 ppm) and increase of 50.97% over control. URP I maintained highest available P with oxalic acid@0.5 M (4.72 ppm) with an increase of 44.51% over control .Jhabua Rock Phosphate (JRP) responded maximum with FYM making available P (4.04 ppm) with an increase of 36.35%. In the second approach, a pot experiment was conducted in glasshouse during Rabi with chickpea variety JG-12 as a test crop. Data emanated from greenhouse experiments with chickpea JG-12 and RP treatments along with F4-FYM +PSB +gluconic acid + zeolite showed significant uptake of N (111.49 mgpot⁻¹), S(16.80 mgpot⁻¹), Cu(36.38µg pot⁻¹) and Fe(3.98mg pot⁻¹). Whereas, F3- FYM+PSB +Oxalic acid showed a maximum uptake of P (20.44 mgpot⁻¹), K (109.55 mgpot⁻¹), Zn(227.63 µgpot⁻¹) and Mn (479.05µg pot⁻¹). The treatment in which URP II was applied in pots showed highest uptake of macro and micronutrients by chickpea. P uptake was maximum (19.77 mgpot⁻¹) with URP II among all the 3 Rock Phosphate's. Thus, it can be concluded that application of indigenous RP sources along with low molecular weight organic acids such as gluconic and oxalic acid along with PSB and FYM influenced the content, uptake and fertility of soil. Moreover, proved to be the promising P source to chickpea that could be used as an alternative to the costly P-fertilizers.

Key words: Rock phosphate, Chickpea, Soil, Organic acids, FYM, Uptake

PHYSICOCHEMICAL PROPERTIES AND CARBON STORAGE OF FOREST SOILS IN TOSAMAIDAN, KASHMIR MIR RIZWAN QAZI*, FAROOQ AHMAD LONE AND JAVEED IQBAL AHMAD BHAT DIVISION OF ENVIRONMENTAL SCIENCES, SKUAST-K, JAMMU AND KASHMIR

The present investigation was carried out in Tosamaidan for assessment of soil carbon (t/ha) and physicochemical properties of soil for different strata in the study area. After conducting a pilot survey, study area was divided into three forest strata including fir, mixed forest and grassland. The quadrats were laid for recording field parameters In terms of pH, the soil was moderately acidic for grassland (5.7) and slightly acidic in both fir (6.2) and mixed forest strata (6.5). Electrical conductivity was recorded highest in mixed forests (0.42 dSm⁻¹) followed by fir (0.34 dSm⁻¹) and grassland (0.20 dSm⁻¹). Bulk density was recorded highest in mixed forest (1.24 g/cm³) followed by fir (1.18 g/cm³) and grassland (1.02 g/cm³). Highest moisture content was recorded in grassland strata (30.77%) followed by fir (26.20%) and mixed forest (25.58%). The texture class of soil was loam for fir, loam for mixed forest (2.61%). The highest soil CO 2 mitigation density 342.80 t/ha was recorded in the grassland strata followed by fir (301.60 t/ha) and the lowest soil organic carbon stock (299.27 t/ha) was recorded for mixed forest strata. Using acquired data with GIS maps showing physicochemical properties and carbon pools were generated.

Keywords: Carbon Sequestration, Soil properties, Soil mapping and Carbon pool

BIOCHAR: SUSTAINABLE SOURCE FOR SOIL MANAGEMENT

TIRUNAGARI RUEPSH¹ AND SWETHA DHEGAVATH² ¹DEPARTMENT OF SOIL SCIENCE AND AGRICULTURAL CHEMISTRY, MPUAT, RAJASTHAN. ²DEPARTMENT OF SOIL SCIENCE & AGRICULTURAL CHEMISTRY), PJTSAU, HYDERABAD.

Biochar is a carbonaceous recalcitrant product of biomass produced through the process of pyrolysis. The use of biochar as a soil amendment is closely linked with its potential for climate change mitigation by carbon sequestration. Specifically, the properties of biochar include resistance to microbial degradation and chemical transformations, high surface areas, high water retention capacity, cation-exchange capacity, and its effectiveness as support and substrate for soil microbes. These characteristics endow biochar with a greater potential to become a highly useful source of materials for improving agricultural productivity through soil quality enhancement while simultaneously sequestering CO₂ from the atmosphere to mitigate climate change. The pH of biochar increases with increasing pyrolysis temperature, therefore, it is sensitive to pyrolysis conditions rather than the type of feedstock used. This process can be linked to the loss of some acidic surface functional groups of biochar at higher pyrolysis temperature. Application of biochar has led to improvement in soil fertility and crop productivity and crop response varied with the physicochemical nature. Biochar addition may increase the water retention close to saturation. Biochar has a bulk density much lower than that of mineral soils and, therefore, application of biochar may increase the volume of unit weight soil and thereby reduces the bulk density of the soil. Biochar additions can increase the pH of amended soils by 0.4–1.2 pH units, with greater increases observed in sandy and loamy soils than in clayey soils. It also positively increased the soil pH in acidic red soil. Earthworms and microorganisms are responsible for performing ecosystem engineering tasks in soil, specifically for nutrient cycling, organic matter degradation and soil hydrology. Biochar can promote the activity of microorganisms, but there is little evidence of its effect on soil fauna.

CARBON SEQUESTRATION IN CROPPING SYSTEMS RAGHUVIR SINGH MEENA¹

DEPARTMENT OF AGRONOMY, MPUAT, RAJASTHAN.

Carbon sequestration is defined as trapping the carbon in the soil. The importance of carbon is not just about forming the organic matter of soil. It also acts as a source of energy for microbial activities in soil, which is a vital indicator for soil health. It is also responsible for available water capacity in the soil, infiltration rate, aggregate formation, soil bulk density, cation exchange capacity, presence of adequate soil enzymes and the level of activity of bio indicators. Using soil carbon sink can turn the surplus farmlands into natural ecosystems, which can provide various ecosystem services. Cropping systems, such as crop rotation, intercropping, cover cropping provides an excellent strategy to improve carbon sequestration for mitigation of climate change. It plays a crucial role by influencing the optimal yield, total increased carbon sequestrated with biomass, and that remained in the soil. A long-term study with corn and cropping systems indicated that the corn-soybean rotation system had the greatest productivity and returned the largest crop residues in the soil. Mixed cropping of corn, bean and cucurbits provided optimal productivity with corresponding quantity of biomass returns and soil carbon sequestration. In relay cropping of wheat and soybean land can be well covered and efficiently utilised to produce economic yield and improve biomass accumulation. Growing of cover crops like rye, oats and clover also reported the increase in soil organic carbon sequestration by 68%. It restores the degraded soils, enhances the land productivity, improves the diversity, protects the environment and reduces the enrichment of atmospheric CO₂, hence shifts emission of GHG and mitigates the climate change.

DISSIPATION AND RISK ASSESSMENT OF TRIFOXYSTROBIN AND ITS METABOLITE IN GREEN PEA SUSHIL AHLAWAT AND REENA CHAUHAN

DEPARTMENT OF CHEMISTRY, CHAUDHARY CHARAN SINGH HARYANA AGRICULTURAL UNIVERSITY HISAR-125004, HARYANA

The role of pesticides in augmenting agricultural output has been well perceived and these have been considered as essential inputs in agricultural production. There are several reports which show the presence of various types of pesticide residues in sweet pea, sometimes above maximum residue levels (MRLs), and their impacts on human health. Therefore, a field experiment was conducted to study the persistence and residues of trifloxystrobin, its metabolite (CGA 321113) in green pea following foliar application thrice at the interval of seven days of the combination product under brand name of Nativo 75 WG @ 350 and 700 g a.i. ha⁻¹. Green pea, Seeds, shell, fodder and soil under crop were analyzed on GC and GC-MS/MS.

Trifoxystrobin- The corresponding persistence of trifloxystrobin on sweet pea reached below LOQ on 10th day and 15th day after the last spray at recommended and double the recommended doses with Half-life values of 1.55 and 3.03 days. Residues of trifloxystrobin in succulent seeds (shelled) at the application rate of 87.5 g a.i./ha were not detected on 0 day and on 1st day 0.071 mgkg⁻¹ was determined. At application rate of 175 g a.i./ha residue was detected on 1 and 3 day i.e. 0.149 and0.069 mgkg⁻¹ .CGA321113-Residue of trifloxystrobin metabolite was also studied on peapods with seed. Initial deposits of its metabolite was 0.122 and 0.258 mg kg⁻¹ at the application rate of 87.5 g a.i./ha and 175 g a.i./ha, respectively and persist up to5th and 7th days after last application. Half-life values (RL50) were calculated to be 1.66 and 2.78 days, at respective doses Residues of trifloxystrobin plus its metabolite in mature pod with seed, mature seed (shelled), dry fodder (without root and pod) and soil under crop found are below limit of quantification i.e. 0.05mg/kg. **Keywords**: Persistence, Metabolite, Foliar spray, Ready-mix, GC-MSMS, Soil

EFFECTS OF SILICON IN RICE UNDER BIOTIC AND ABIOTIC STRESSES

B. SRI SAI SIDDARTHA NAIK¹ AND SWETHA DHEGAVATH² ¹DEPARTMENT OF AGRONOMY, MPUAT, RAJASTHAN.

²DEAPRTMENT OF SOIL SCIENCE & AGRICULTURAL CHEMISTRY, PJTSAU, HYDERABAD.

Silicon (Si) is the second most abundant element in the earth's crust. It is considered as a beneficial element for crop growth, especially for Poaceae crops like Rice. Rice is a typical silicon accumulating plant and it benefits from silicon nutrition. Its supply is essential for healthy growth and economic yield of the rice crop. Considerable damages to plants caused by abiotic stresses such as drought stress, salinity stress, heavy metal stress and nutrient imbalance, as well as biotic stresses like insect pests and pathogens and even herbivorous attacks, have been reported to be reduced significantly by silicon application. The deposition of silica on epidermal layers offers a physical barrier to insects by preventing the physical penetration by insects. Si might form complexes with the organic compounds of cell walls of epidermal cells, thus increasing their resistance to the enzymes expounded by the pathogen. The antifungal compounds like momilactones were found to accumulate in Si treated rice plants. Silicon increases the oxidizing power of roots, which converts ferrous iron into ferric iron, thereby preventing a large uptake of iron and limiting its toxicity. Silicon regulates Fe uptake from acidic soils through the release of Hydroxyl ions (OH⁻) by roots. Excessive salinity in cropping soil is a worldwide problem due mainly to rising water tables. Si may alleviate salt stress in higher plants either by improved photosynthetic activity, enhanced K/Na selectivity ratio, increased enzyme activity, and increased concentration of soluble substances in the xylem and by increasing resistance to drought stress. Based on all the above benefits, it is concluded that the supply of silicon is most important for plant growth especially for rice to increase its productivity.

EMPOWERMENT OF FARMERS THROUGH THE USE OF ICT

POKA MALINI¹

DEPARTMENT OF EXTENSION EDUCATION, MPUAT, RAJASTHAN.

The occupational structure of India is dominated by the "agricultural sector" (53%) and next the "manufacturing sector" and the "service sector" which were far lagging behind and we know that major of the farmers in India are of small and marginal farmers (80%). This shows that India is predominantly an agricultural economy and the future of sustainable agriculture growth and food security in India depends on the performance of small and marginal farmers hence it is required for strongest protection and development of "agricultural resources". ICT applications can foster dissemination of information on technology, market demand and price information; weather pest, and risk-management information, best practices to meet quality and certification standards. Some of the well popularized and widely used ICT applications were m-Kisan SMS Portal, Kisan Call Centres, e-Choupal AGMARKNET, KISSAN, i-Kisan, Agri-watch, Indiaagronet, Agropedia and others manage portals providing good on-line information for various clienteles. Precision farming, popular in developed countries, extensively uses IT to make direct contribution to agricultural productivity. Consequently other IT technologies like remote sensing, GIS, autonomous farming will be more suitable for farming in India if taken up on corporate lines. The indirect benefits of IT in empowering Indian farmer are significant and it remains to be exploited. Hence to bridge the information gap between the farmers and to build productive and competitive market, different ICT interventions can be used to support rural and underdeveloped markets to become efficient and productive and also appropriate use of ICTs can facilitate to meet the expectations of Good-Governance in Agriculture by improving transparency and Farmers' participation in Agricultural Planning, implementation and Monitoring and to reach up to over 90% of Farming community (from current level of below 50%), within next 5 years, with Agricultural Information.

ENHANCING DROUGHT TOLERANCE IN CHICKPEA USING GENOMICS APPROACHES

BOMMANA SUVARCHALA¹

DEPARTMENT OF GENETICS & PLANT BREEDING, MPUAT, RAJASTHAN.

Terminal drought is one of the major constraints in chickpea (*Cicer arietinum* L.) leading to more than 50% production losses. To overcome these production losses due to drought, a range of translational genomics approaches are being used in chickpea breeding to develop improved chickpea varieties for enhancing food and nutritional security in developing countries in the context of climate change. For understanding the complex nature of drought tolerance, precise phenotypic data (20 drought component traits evaluated in one to seven seasons at one to five locations in India on two intra-specific mapping populations - ICC 4958 × ICC 1882 and ICC 283 × ICC 8261) together with extensive genotyping data was analyzed. As a result, nine QTL clusters containing QTLs for several drought tolerance traits have been identified, which can be targeted for molecular breeding. Among these clusters, one cluster harbouring 48% robust M-QTLs for 12 traits and explaining about 58.20% phenotypic variation present on CaLG04 has been referred as "*QTL-hotspot*". This genomic region contains seven SSR markers (ICCM0249, NCPGR127, TAA170, NCPGR21, TR11, GA24 and STMS11). This QTL region has been introgressed in several leading varieties (e.g. JG 11, Chefe, KAK2) by using marker-assisted backcrossing (MABC) approach. Multilocation evaluation of these MABC lines provided several lines that have up to 24% higher yield than the recurrent parents. Introgression of this region into other elite cultivars will enhance production and productivity in chickpea.

IMPACT OF CLIMATE CHANGE ON INSECT PESTS

SWATHI PENUBALLI

DEPARTMENT OF ENTOMOLOGY, MPUAT, RAJASTHAN.

Climate change, especially rise in temperature and atmospheric carbon dioxide (CO₂) concentration, is a major concern today. According to Intergovernmental Panel on Climate Change (IPCC), it is defined as "Change in climate overtime, either due to natural variability or as a result of human activity". Insects are among the groups of organism most likely to be affected by climate change because climate has a strong direct influence on their development, reproduction and survival. Insects have short generations time and high reproductive rates, so they can more like to respond quicker to climate change than long-lived organisms, such as plants and vertebrates (Menendez., 2007). Mainly increase in temperature and atmospheric CO₂ can influence growth and development of herbivore insects either directly or indirectly. The alternation in food quality under elevated CO₂ i.e., decreased foliar N and increased C: N ratio, effects the herbivores in the form of increased consumption, reduced growth rates and extension of larval durations (Rao *et al.*, 2012). Elevated CO₂ levels significantly alter the quality of castor foliage resulting in higher consumption by larvae, longer time to pupate and reducing the fecundity of adults over generations (Srinivasa Rao *et al.*, 2013). Rachappa *et al.* (2016) observed that there is positively significant correlation with maximum temperature and negatively significant correlation with rainfall and relative humidity.

The rapid climate change also influences the insect evolution and makes its adoption to climate change an indispensible thing in its evolution as the insect migration largely depends on the abiotic factors such as temperature, relative humidity, wind currents, direction and rainfall. The insect migration in the pretext of climate change will result in arrival of new insect pest to new geographical region. Thus the insect migration and behaviour needs to be studied in an extensive manner in the changing climate scenario.

NANOPEDOLOGY AND ITS APPLICATIONS IN AGRICULTURE JITENDRA SINGH BAMBORIYA

DEPARTMENT OF SOIL SCIENCE AND AGRICULTURAL CHEMISTRY, MPUAT, UDAIPUR.

Nanotechnology is the understanding and control of matter of sizes roughly in the range of 1 to 100 nanometers. If one of the dimensions is in this range, it is considered a nanoparticle. Bulk materials when reduced to the nanoscale show some properties such as melting point, physical strength, surface area, penetration power, electric conductance, optical effect, magnetism etc. which are different from what they exhibit on a macro scale enabling unique applications. These materials can be either natural or engineered. At nanoscale, gravity would become less important, whereas surface tension and van der Waal forces would become more important. An example is new emerging disciplines - nanopedology. This is a new off-shoot of pedology; a discipline that involves study of soil as a natural body. Nanopedology converges soil mineralogy with imaging techniques and artificial intelligence. Examples of impending opportunities are in the areas of establishing relationships between hereto vaguely-matched properties between bio molecules and polymer, and microscopic atoms and molecules, and establishing relationships between macroscopic properties (thermodynamics) and microscopic properties, where among others kinetics, wave theory, and uncertainty principles find place.

SOIL HEALTH CARD A TOOL TO REDUCE FERTILIZER OVERUSE SUMI P

DEPARTMENT OF SOIL SCIENCE AND AGRICULTURAL CHEMISTRY, MPUAT, RAJASTHAN.

Soil Health Card (SHC) is a Government of India's scheme launched in 2015, promoted by the Department of Agriculture & Co-operation under the Ministry of Agriculture and Farmers' Welfare. SHC is a printed report that a farmer is handed over for each of his holdings. It contains the status of soil with respect to 12 parameters, namely N, P, K (Macro-nutrients); S (Secondary- nutrient); Zn, Fe, Cu, Mn, Bo (Micro - nutrients); and pH, EC, OC (Physical parameters). Based on which the SHC will indicate fertilizer recommendations and soil amendment required for the farm. A Soil Health Card is used to assess the current status of soil health and are used over time, to determine changes in soil health that affected by land management. The regular use of card will allow farmers to record long term trends in soil health and to assess the effects of different soil management practices. To support this initiative Indian Space Research Institute (ISRO) has launched mobile application along with web portal. Currently, SCHs are now being provided through the BHUVAN portal in six states, namely, Andhra Pradesh, Assam, Haryana, Tamil Nadu, Telangana and West Bengal. These interfaces works together and helps in registrations of soil samples, recording tests results for soil samples and generation of SHCs along with fertilizer recommendation. This app works like other Geotagging apps developed for the Rashtriya Krishi Vikas Yojana. Soil Health Card portal aims to generate and issue SHCs based on either Soil Test-Crop Response (STCR) formulae developed by ICAR or General Fertilizer Recommendations provided by State Governments. Indian farmers, who commonly overuse fertilisers in almost everything they grow, are being slowly nudged away from the dangerous practice, resulting in productivity gains; a study of the national soil-health-card scheme has shown.

TEAM-CD – A WEB BASED DECISION SUPPORT SYSTEM FOR COMMERCIAL DAIRY FARMING

ARTI^{1*}, SMITA SIROHI², P.S. OBEROI³ AND CHANDAN KUMAR RAI⁴ ¹DES&M DIVISION, ICAR-NDRI KARNAL ³LPM DIVISION, ICAR- NDRI KARNAL, HARYANA ⁴DAIRY EXTENSION DIVISION, ICAR-NDRI KARNAL

TEAM-CD (Techno-Economic AssessMent of Commercial Dairy Farm) is a decision support system based on the scientific principles of animal husbandry and economics. The web app consists of input delivery, Data Analysis and final the formation of bankable techno-economic feasibility report. This app is helpful for generating techno-economic feasibility report for commercial dairy herd of 10 to 500 adult females. There were various private and public resources available in domain. The private consultants charge highly for preparing one report, whereas public resources were out of reach of the farmers' domain. The app which we have developed provides the bankable project report with zero cost. It has 6 input and 10 output modules. The project report is generated in the pdf format after the user reaches the last module. TEAM-CD is useful for pre-feasibility study and planning of farm-level investment. It is available on ICAR-NDRI website (www.ndri.res.in) with link TEAM-CD.

Keywords: Techno-Economic Feasibility, Financial Analysis, Herd Projections, Repayment Schedule.

ASSESSMENT OF ANTIBACTERIAL ACTIVITY OF DIFFERENT DRIED POMEGRANATE (CV. GANESH) PEEL EXTRACT

NISHANT KUMAR¹*, NEERAJ² DEPARTMENT OF AGRICULTURE AND ENVIRONMENTAL SCIENCES, NATIONAL INSTITUTE OF FOOD TECHNOLOGY ENTREPRENEURSHIP AND MANAGEMENT, KUNDLI - 131028 (SONIPAT), HARYANA, INDIA

The present study aimed to evaluate the effect of drying (freeze, tray and sun) and solvent (methanol, ethanol, water, acetone and hexane) on the antibacterial activity of extract from pomegranate by products. Antibacterial activity against six strains of pathogen (*S. thermophilus P. aeruginosa, E. coli, Bifidobacteria, E. faecalis and L. acidophilus*) were determined. The pomegranate peel extract was prepared by using ultra sonic assisted extraction (Ultrasonic bath) using five different solvents. All prepared pomegranate peel extracts demonstrated selective antimicrobial activity against all pathogenic bacteria. The extraction of freeze drying powder in methanol showed maximum inhibitory concentration at 20, 25, 30 and 35µl volumes followed by ethanol, water and acetone. Extraction in hexane solvent did not showed inhibitory concentration against selected pathogenic strains.

Key words: Pomegranate Peel; Drying; Solvents; Extraction; Antibacterial Activity

USE OF MOLECULAR MARKERS IN A SEGREGATING POPULATION OF SOYBEAN TO IDENTIFY THE SUPERIOR LINES HAVING YMV RESISTANT CHARACTERISTICS

DIBYABHARATI SAHU

DEPARTMENT OF PLANT BREEDING AND GENETICS, ROOM NO 45, MAA JHADESWARI GIRLS HOSTEL NO 3, OUAT, BHUBANESWAR-751003

Hybridization is an important breeding method to bring together the desirable genes from two parents into a single genotype. The experiment was conducted at two locations *viz*.Ludhiana and Gurdaspur. In the present investigation, 45 F_{2.7} lines derived from cross of SL 525 (a yellow mosaic resistant variety) and JS 335 (a widely adapted cultivar but susceptible to YMV) were evaluated with SSR markers. 120 SSR markers were applied to parents, out of which 17 markers resulted polymorphism in them. Then these polymorphic markers were applied in the population constituted of abovesaid 45 derived lines. The lines were evaluated on the basis of agronomic traits and parental contribution. Parental contribution of each line was calculated on the basis of behaviour of markers towards the parents. Molecular diversity analysis categorized the genotypes into 3 clusters. Cluster A consisted of 26 genotypes including parent JS 335 and cluster B consisted of 12 genotypes including parent SL 525 and cluster C of 9 genotypes. Genotypes present in cluster C had nearly equal contribution of both the parents. Genotypes SLJS 41-2 (32.1g/ plant) and SLJS 43-7 (32.4 g/plant) both are present in cluster C which had 62.5 and 52.94 per cent contribution of JS 335, respectively. These two lines were better yeilder than JS 335 were also resistant to yellow mosaic virus.

FOOD SECURITY IN INDIA : ISSUES, CHALLENGE AND OPPORTUNITIES

ANUP SINGH SANGWAN AND BABU LAL SHARMA PT. JLN GC FARIDABAD,HARYANA GOVT. COLLEGE PALWAL,HARYANA

Food is considered among basic amenities essential for the substances and growth of an individual. A nation may acquire self-sufficiency in food at a point of time, but the concept of food security supply of food should be available on a long-term basis. Food security ensure that all people at all times have both physical and economic access to basic food they need and the food available should be a adequate in quality as well as quantity to meet nutritional requirements for healthy life. To tackle the quantitative and qualitative aspects of food security problems, the Government of India has relied on the three food based safety nets : Public Distribution System (PDS), Integrated Child Development Scheme (ICDS) and Mid-day-Meals Programme (MDM). The Government has also introduced various employment programmes to improve the purchasing power of the concerned people. But the growing population, environment degradation, limited natural resources and climate change pose a big challenge to the food security of human population. So food security in India is a adversely affected by several abiotic, biotic and socio-political situations like, decline in per capita land and decreasing farm size is another reason for agricultural crises. Land issues such as SEZS, land going to non-agriculture, drought situation, alienation of tribal land etc. are become important. If timely and appropriate actions are not planned and executed the current situation may worsen the future. The objective this paper is study the performance, challenge and policies regarding food security and what should be done to realize food and nutrition security for all the citizens of India.

Keywords: Food Security, Environmental degradation, Self-sufficiency, Quantitative, Quantitative.

STATUS AND DISTRIBUTION OF DIFFERENT FORMS OF POTASSIUM IN SOILS OF ASHOKNAGAR DISTRICT (M.P.)

SONU KORI¹, SK SINGH², RAHUL MORYA², HEMLATA DHAKAD², SULEKHA KESHRI² AND BK RAJPUT² DEPARTMENT OF SOIL SCIENCE AND AGRICULTURAL CHEMISTRY, RVSKVV GWALIOR (MP)

The study was conducted during 2016-17 at Ashoknagar district (M.P.) having 150 GPS based surface soil samples (0-15 cm) collected from five blocks (namely; Mungaoli, Chanderi, Ishagarh, Ashoknagar and sadora) of Ashok Nagar district. The samples were prepared and analyzed for physico-chemical properties and different forms of potassium. The average shares of lattice potassium, non-exchangeable, exchangeable and water soluble potassium in the 'total' potassium were more than 90%, 4.0%, 1.0% and 0.4% respectively. The results showed that the average values for water soluble-K, exchangeable-K, non-exchangeable-K, lattice-K and total K were: 17.6, 161.1, 614.8 mg /kg, 1.334% and 1.409%, respectively. Highly significant and positive relationship was observed between different forms of K. **Key words:** Water soluble K, Exchangeable K and Non-exchangeable K

NANOCELLULOSE EXTRACTION AND CHARACTERIZATION FROM DIFFERENTLY SIZED RICE HUSKS SUMIRA RASHID¹, HIMJYOTI DUTTA², VINOD KUMAR MODI¹

¹AMITY INSTITUTE OF FOOD TECHNOLOGY, AMITY UNIVERSITY UTTAR PRADESH, NOIDA, INDIA ²DEPARTMENT OF FOOD TECHNOLOGY, MIZORAM UNIVERSITY, INDIA

A hypothesis was designed that the structural differences in plant parts of similar origin but with different sizes could be governed by their nanostructural differences. For this, nanocellulose was extracted from husks of different sized rices, namely short, medium and long grain types. Delignification and acid hydrolysis successfully removed the non-cellulosic hemicellulose and lignin component and subsequently enhanced the crystallinity. Heat stability of celluloses was higher than husks. This also altered infrared diffractions patterns. SEM observation revealed that the cellulose fibrils formed compact blocklets varying in size in rice husk. Acid hydrolysis caused the liberation of smooth surfaced cellulose nanowhiskers observed under TEM and AFM. The nanowhiskers varied in sizes (diameter =11.7-28.9 nm, 16.1-37.5 nm and 19.9-48.3 nm; length = 55.7-178.6 nm, 111.2-476.7 nm and 153.1-778.9 nm), aspect ratio = 6.4, 9.8 and 16.9, crystallinity indices = 58.82%, 62.32% and 76.69% and zeta potential = -33.8 mV, -27.1 mV and -21.3 mV. Native cellulose polymorphism remained unaltered during the extraction process showing XRD peaks at 16.3°, 22.4° and 34.5° respectively. The constructional characteristics of long husk nanowhiskers were superior in size, strength, crystallinity, thermal stability followed by medium and short husks. Nanocellulose samples presented lesser than 0.1% hemolysis against goat blood erythrocytes. The study suggested potential applicability of the extracted rice husk nanocelluloses as heat resistant materials and in food, cosmetic and pharmaceutical formulations. **Key words:** rice husk, nanocellulose, characterization, crystallinity, toxicity

EFFECT OF IMMUNOMODULATOR IN GROWTH PERFORMANCE OF BROILER CHICKS DINESH MAHTO

KRISHI VIGYAN KENDRA, GANDHAR, BANDHUGANJ, JEHANABAD, (B.A.U, SABOUR) BIHAR: 804432

The present investigation was carried out to study the effect of E & selenium/E-Care Se forte and Herbal Immunomodulator on growth performance of broiler chicks. A total of six hundred commercial broiler chicks selected at organized poultry farmers at Jehanabad district. Initially kept under hover for first 6th to 7th day they were grouped randomly in three groups of 200 chicks each. Use of poultry feed with supplementation of any medicine was given to Group I only directly in feed @ 50g/100 kg of feed, Group II was E & selenium/E-Care Se forte: 20ml/day for 200 birds orally and Group III was Herbal Immunomodulator: 20ml /day for 200 birds orally. All the chicks were maintained under similar conditions in terms of feeding, vaccination, electrolyte and other manage mental provisions. Growth rate was studied at weekly interval from 1st week to 4th week of age. The effect Immunomodulator treatment had significant influence on body weight gain at 28 days. Group III gained 1571±40.82 grams body weight at the end of 4th week of experiment while group II showed 1457 ± 40.44 grams as compared to control group 1235 ± 34.63 grams. Total B:C ratio during the 28 days of experimental period. The higher feed consumption during the period under study was observed in herbal Immunomodulator (Adimmone) treated group III (50.50 kg) and vaccinated control group I (50.37 kg) followed by E & selenium/E-Care Se forte group III (2:1), followed by (1:9) and (1:6) in E & selenium/E-Care Se forte and control group respectively. The concluded that the result was found Gr III Herbal Immunomodulator (Adimmone) is better than that of others groups for growth performance in broiler chicks in respect of B: C ratio (2.1) due to control of heat stress.

DEVELOPMENT OF MULTIPLEX PCR FOR SIMULTANEOUS DETECTION OF ALTERNARIA PADWICKII AND BIPOLARIS ORYZAE FROM RICE SEED

PARDEEP KUMAR*, JAMEEL AKHTAR, RAJ KIRAN, MEENA SHEKHAR, KRISHNA NAIR, SADHANA MAURYA AND SC DUBEY

DIVISION OF PLANT QUARANTINE, ICAR-NBPGR, PUSA CAMPUS, NEW DELHI, INDIA-110012

Alternaria padwickii and Bipolaris oryzae are fungal pathogens causing stackburn and brown spot disease of rice, respectively and results in considerable yield losses across the world. The primary source of inoculum for these two pathogens are infected rice seeds. Therefore, for rapid and simultaneous detection of *A. padwickii and B. oryzae* in a single reaction a highly specific and sensitive multiplex PCR has been developed. A set of primers namely BoSP7-F and BoSP7-R designed from *Bipolaris oryzae* ATCC 44560 unplaced genomic scaffold scaffold_136 whereas ApEF-1F and ApEF-1R were designed from elongation factor 1 region of *A. padwickii*. The specific bands of 175 bp for *A. padwickii* and 325 bp for *B. oryzae* were obtained in multiplex PCR. The detection sensitivity of the primer pairs were performed by dilution of genomic DNA and results revealed that it could detect upto 0.1 ng μ l⁻¹ of template DNA of both the pathogens. These primers are specific to *A. padwickii* (BoSP7-F and BoSP7-R) and *B. oryzae* (ApEF-1F and ApEF-1R) and there were no cross amplification with other related fungal and bacterial pathogens. So, the multiplex PCR assay developed could be utilized for a reliable and simultaneous detection of two major seed-borne pathogen of rice.

Key words: Alternaria padwickii, Bipolaris oryzae, Multiplex PCR, Rice seed

EFFECT OF DIFFERENT PLANT SPACING, PRUNING INTENSITY ON FLOWERING, GROWTH, YIELD AND QUALITY IN L-49 AT TIKAMGARH DISTRICT OF MADHYA PRADESH

V. K. SINGH¹, RAVI YADAV², RAVI SHANKAR RATRE³

DEPARTMENT OF HORTICULTURE, J.N.K.V.V., COLLEGE OF AGRICULTURE, TIKAMGARH (M.P.)

The present disquisition was convened at Horticultural Research Farm, College of Agriculture, Tikamgarh (Madhya Pradesh) was convened during the years 2017-18 with a view to studying Effect of different plant spacing, pruning intensity on flowering, growth, yield and quality of L-49 guava (*Psidium guajava* L.) were planted on 16 August, 2008 in the field at three different spacings, viz. 5x5 m, 5x6 m, 6x6 m,5x4 m and 4x6 m apart under a planting system. The character such as number of flower plant⁻¹, plant height (m)Girth of stem(cm), plant spread, fruit weight, number of fruits plant⁻¹, fruit yield tree⁻¹, T.S.S., acidity, vitamin C and total sugars. Experimental results mentioned above revealed that the maximum quantities and quality of the tree spread in East-West direction was recorded at medium spacing 5m x 5m in suitable climate condition on the Tikamgarh district in the Bundelkhand region of Madhya Pradesh. **Keyword**: Tikamgarh, spacing, growth, yield, quality.

EXPLORING THE ROLE OF FARMER PRODUCER ORGANIZATIONS IN ENHANCING FARMER INCOME SUNIL KUMAR, GOPAL SANKHALA, CHANDAN KUMAR RAI

DIVISION OF DAIRY EXTENSION EDUCATION ICAR-NDRI KARNAL

A Producer Organization (PO) could be a legal entity formed by primary producers, viz. farmers, milk producers, fishermen, weavers, rural artisans and craftsmen. A PO may be a producer company, a cooperative society or the other legal type that provides for sharing of profits/benefits among the members. The main aim of PO is to confirm higher financial gain for the producers through a company of their own. When all members of producer organization are farmers it is called as farmer producer organization. Through aggregation, the primary producers can avail the benefit of economies of scale. Producer firms will facilitate farmers participate in rising high-value markets, such as the export market and the unfolding modern retail sector in India. The withdrawal of the state from productive and economic functions, and changes within the organization of selling channels, threw new challenges for small-scale farmers. In this environment of greater instability and competition, farmer producer organization and collective action of farmers can help to enhance farmers' competitiveness and increase their agricultural income.

Keyword: Producer organization, markets, farmer producer organization, primary producers

INTEGRATED MANAGEMENT OF DISEASES OF BLACK GRAM (*VIGNA MUNGO*) IN ASSAM PRANAB DUTTA¹, <u>ARTI KUMARI²</u>, GAURAV PHOOKAN³, BISHAL SAIKIA⁴, M. S. RAO⁵ AND PRADIP BHOWMICK⁶ 1, 2, 3, 4 & ⁶DEPARTMENT OF PLANT PATHOLOGY, ASSAM AGRICULTURAL UNIVERSITY, JORHAT, ASSAM ⁵RETD. PRINCIPAL SCIENTIST, IIHR, BANGALORE, KARNATAKA

A field experiment was conducted at the experimental farm of Department of Horticulture, Assam Agricultural University, Jorhat, Assam to formulate an Integrated Pest Management module for management of diseases of black gram (*vigna mungo*) in Assam conditions. Six different treatment combinations were tested *viz.*, T1: Control (Incorporation of dhaincha, *Sesbania bispinosa*), T2: T1 + *Trichoderma viride* incorporation, T3: T2 + Seed treatment with All Rounder (Arka Krishi), T4: T3 + *T. viride* enriched vermicompost application @ 5 tonnes/ha, T5: T4 + application of neem pesticides, T6: T5 + Seed treatment with Rhizobium. Observations were recorded on percent disease incidence for major diseases of black gram *viz.*, Web blight, Cercospora leaf spot and viral infections and percent pest infestation. Plant growth parameters and total yield of the crop were also recorded. Results revealed that the minimum disease incidence was observed on application of treatment T6 i.e., application of dhaincha+ *T. viride* + seed treatment with All Rounder + *T. viridae* enriched vermicompost + neem based pesticides + seed treatment with Rhizobium followed by treatment T2 i.e., incorporation of dhaincha + *T. viride*. Also, the plant growth parameters i.e pod length, number of seeds per pod, plant height and total yield of black gram was found highest in treatment T6. Thus, the treatment T6 provided effective disease management with increased plant health and total yield. **Key words:** Black gram, disease, Trichoderma, Rhizobium

EFFECT OF ZNO NANOPARTICLES ON KARYOMORPHOLOGY AND BIOCHEMICAL CHANGES OF CAMELLIA SINENSIS

TWAHIRA BEGUM¹, HIMADRI KAUSHIK², <u>GAURAV PHOOKAN³</u>, ARTI KUMARI⁴, R. P BHUYAN⁵ AND PRANAB DUTTA⁶

^{2,3, 4&6}DEPARTMENT OF PLANT PATHOLOGY, ⁵DEPARTMNET OF TEA HUSBANDRY AND TECHNOLOGY, ASSAM AGRICULTURAL UNIVERSITY, JORHAT-785013, ASSAM

¹MEDICINAL, AROMATIC AND ECONOMIC PLANT GROUP, NORTH EAST INSTITUTE OF SCIENCE AND TECHNOLOGY, JORHAT-785006, ASSAM

Tea (*Camellia sinensis* Fam.:Theaceae is an evergreen shrub native to East Asia is a perennial plant with immense health benefits. It is mostly consumed as a daily beverage all around the globe. Genetic heterogeneity along with morphological, physiological and biochemical differences has amplified due to open cross-pollination between the heterozygous tea plants over past several years. Improvement in quality and yield of tea as in other perennial cross-pollinated crops through conventional breeding is time consuming and is practically challenging. For formation of superior genotypes and accepting the genetic basis of variation, growth, yield and quality parameters of tea, the knowledge of karyotype is crucial. It is required to determine the chromosome morphology and other diagnostic feature of the chromosomal component. It is an established fact that karyomophological analysis forms a prerequisite for the genetic improvement of any plant species. Therefore, the detailed cytological investigation has been undertaken in *C. sinensis* to study the effect of ZnO nanoparticles on the karyotype of the plant. During the present karyomorphological study, the tea plants were inoculated with ZnO Nano particle at different dosage by following standard protocol. Result shows that the inoculation of ZnO Nano particle induced the formation of less asymmetrical karyotype than that of untreated plant. Hence, the plants treated with ZnO nanoparticles were primitive than that of untreated plants. Whatsoever, the treatment with nanoparticles didn't had any negative impact and also resulted in higher production of m,ajor secondary metabolites. Thus the present study has revealed that nanoparticles can prove to be beneficial in breeding programme as they donot impose any negative impact on the plant and also have the potential to increase higher production of secondary metabolites in the plants which will be beneficial to health and also beneficial to plant growth.

Key words: Nanoprticles, karyomorphology, tea plants, plant metabolites

AW2PHASE ASSISTED PHARMACOPHORE MODEL DEVELOPMENT OF PYRIDOPYRAMIDE DERIVATIVES OF ACETYL CHEINESTERASE INHIBITORS FOR TREATMENT OF ALZHEIMER'S DISEASE

SWETA RAI¹, PRASHANT KUMAR², SANCHITA PAL³

KASHI INSTITUTE OF PHARMACY, MIRZAMURAD ,VARANASI¹

DEPARTMENT OF BIOTECHNOLOGY, MOTILAL NEHRU NATIONAL INSTITUTE OF TECHNOLOGY, ALLAHABAD² DEPARTMENT OF ANIMAL NUTRITION, SARDAR VALLABHBHAI PATEL UNIVERSITY OF AGRICULTURE AND TECHNOLOGY, MEERUT³

Pharmacophoric model development exploration was expected to provide design information for drug with high selectivity of inhibition toward Acetyl cholein esterase enzyme, the proposed 3D computational model performed by phase and generated taking into account a number of structurally diverse compounds characterized by a wide range of selectivity index values. The model proved to be predictive,

with r2 of 0.95 and Q2 of 0.36. In order to get prospective experimental validation, the selectivity of an external data set of 39 compounds reported in the literature was predicted. The correlation coefficient (r2=0.95) obtained on this unrelated test set provided evidence that the correlation shown by the model was not a chance result. Subsequently, we essayed the ability of our approach to help the design of new Acetyl choline esterase enzyme.

Keywords: r = regration analysis, $Q^2 = applied$ correlation coefficient value for test set, $r^2 = correction$ coefficient, Validation, QSAR, Computational model

ZERO BUDGET NATURAL FARMING FOR SUSTAINABLE DEVELOPMENT OF AGRICULTURE. SANJAM PHUTELA

DEPARTMENT OF SOIL SCIENCE, G.B.P.U. A. & T., PANTNAGAR (U.K.)

Zero Budget Natural Farming is a unique method of farming which requires absolutely no monetary investment for purchase of key inputs like seeds, fertilizers and plant protection chemicals from the market. The farmer can grow hardy local varieties of crops without application of fertilizers and pesticides. Since it is a zero budget farming no institutional credit would be required and dependence on hired labour is also reduced to bare minimum. All that the system requires is native breed of cattle which is any case forms an integral part of farming families in rural areas. It is claimed that one cow is sufficient to take up this method of farming on thirty acres of land. Subhash Palekar, is a famous exponent of natural farming and a tireless promoter of the concept of "Zero Budget Natural Farming" (ZBNF). In India More than a quarter of a million farmers have committed suicide in the last two decades. Various studies have linked farmer's suicides to debt. Debt is a problem for farmers of all sizes in India. Under such conditions, 'zero budget' farming promises to end a reliance on loans and drastically cut production costs, ending the debt cycle for desperate farmers. The word 'budget' refers to credit and expenses, thus the phrase 'Zero Budget' means without using any credit, and without spending any money on purchased inputs. 'Natural farming' means farming with Nature and without chemicals. The four pillars of ZBNF are Jivamrita/jeevamrutha (fermented microbial culture), Bijamrita/beejamrutha (treatment used for seeds, seedlings or any planting material), Acchadana - Mulching (Soil Mulch, Straw Mulch and Live Mulch i.e symbiotic intercrops and mixed crops) Whapasa - moisture. Other important principles of ZBNF are Intercropping, Contours and bunds, Local species of earthworms, Cow dung (dung from the Bos indicus, humped cow). The entire ZBNF method is centred on the Indian cow, which historically has been part of Indian rural life. There are no other official policies to promote ZBNF. A particular challenge is marketing. Many farmers sell their natural produce as if were chemically grown, to private traders or at government wholesale yards, with no price differential. Other farmers rely on their own local marketing networks, such as to some organic shops and individual customers, but policy support in this area is crucial. A survey carried out by LVC suggests that ZBNF works not just in agronomic terms, but also brings about a variety of social and economic benefits. A majority of respondents reported that by adopting ZBNF, over time they saw improvements in yield, soil conservation, seed diversity, quality of produce, household food autonomy, income, and health. Most experienced reduced farm expenses and a reduced need for credit, one of the major problems plaguing Indian farmers. Key words: Zero budget, chemicals, policies.

ECO -FRIENDLY MANAGEMENT OF MAJOR INTERNAL FEEDER IN STORAGE MAIZE. SANGEETA TIWARI* AND SUNITA YADAV DEPARTMENT, OF ENTOMOLOGY, CHADDHADY, CHADAN, SINCH, HADVANA, AC

DEPARTMENT OF ENTOMOLOGY, CHAUDHARY CHARAN SINGH, HARYANA AGRICULTURAL UNIVERSITY; HISAR HARYANA, 125004, INDIA

An investigation was carried out to study the efficacy of eleven seed protectants *viz.*, fly ash (10g/kg), paddy husk (5g/kg), paddy husk ash (5g/kg), tumeric powder (5g/kg), silica gel (20g/kg), neem leaves (20g/kg), eucalyptus leaves (20g/kg), neem oil (15 ml/kg), eucalyptus oil (20ml/kg), canola oil (20ml/kg), boric acid (20g/kg) and untreated control against *Sitophilus oryzae* and *Rhyzopertha dominica*. The experiment was carried out in storage laboratory of Department of Entomology, CCS HAU, Hisar in 2017-2018 and 2018-2019. The efficacy was evaluated on the basis of adult mortality, population growth, percent grain damage, percent repellence and % seed germination. The experiments were layout in Complete Randomized Design in three replications. The results revealed that all the treatments were effective against stored grain insects as compare to control. The oil formulations (neem, eucalyptus and canola oil) were reported as best treatments with maximum adult mortality and repellence whereas minimum percent seed damage and population growth was reported for these treatments. The maximum percent germination was reported for eucalyptus leaves it was followed by fly ash, turmeric powder, neem leaves, neem oil, silica gel, paddy husk, paddy husk ash, eucalyptus oil, canola oil and boric acid (minimum). **Key words:** Neem, eco-friendly, eucalyptus oil, *Sitophilus oryzae and Rhyzopertha dominica*.

ECO- FRIENDLY MANAGEMENT OF TROGODERMA GRANARIUM IN MAIZE.

SANGEETA TIWARI* AND SUNITA YADAV

DEPARTMENT OF ENTOMOLOGY, CHAUDHARY CHARAN SINGH, HARYANA AGRICULTURAL UNIVERSITY; HISAR HARYANA, 125004, INDIA

Khapra beetle (*Trogoderma granarium*) is an important pest of stored maize. The synthetic insecticides are effective in management of Khapra beetle but they are associated with many problems like residue, environmental and health hazard. These problems can be overcome by using eco- friendly management strategies. Keeping this in view an experiment was conducted in storage laboratory of Department of Entomology, CCS HAU, Hisar in 2017-2018 and 2018-2019. The seed protectants *viz.*, fly ash (10g/kg), paddy husk (5g/kg), paddy husk ash (5g /kg), tumeric powder (5g/kg), silica gel (20g/kg), neem leaves (20g/kg), eucalyptus leaves (20g/kg), neem oil (15 ml/kg), eucalyptus oil (20ml/kg), canola oil (20ml/kg), boric acid (20g/kg) and untreated control were evaluated against *T. granarium*, Khapra beetle. The efficacy was evaluated on the basis of adult mortality, population growth, percent grain damage, percent repellence. The results revealed that all the treatments were effective against *Trogoderma granarium* as compared to control. The neem, eucalyptus and canola oil were reported as superior treatments with maximum adult mortality and repellence minimum percent seed damage and population growth was reported for these treatments.

Key words: Neem, eco-friendly, Trogoderma granarium, turmeric and mortality.

FOREST AND NTFPS AS A RESOURCE FOR LIVELIHOODS

*VISHNU K. SOLANKI¹, VINITA PARTE¹ AND J.S.RANAWAT²

¹JAWAHARLAL NEHRU KRISHI VISHWA VIDYALAYA, JABALPUR, (M.P.), INDIA

²HISAR AGRICULTURAL UNIVERSITY, HISAR, HARYANA

Forest is a unique natural and renewable resource which is important not only for ecological security but also in providing livelihood support to a sizable tribal and other forest dependent population. Forest is also a way of life in terms of socially and culturally and also provides economic sustenance. It meets basic needs like fuelwood, fodder and small timber that are important for them and their livestock. Degradation and depletion of the forest resources are increasing poverty and suffering among the rural people. Therefore it is imperative to rehabilitate degraded forest resources in order to sustain rural livelihoods. This is possible only through devolution of power to the people for the management of forest. There have been several popular movements in India to protect the rights of the local people. With the active support of local organizations people's participation in forest management was initiated and is generally known as Joint Forest Management (JFM) in India. Integrated approach for development of forest livelihoods brings significant attitudinal change in communities. Now it is recognized that participatory management of forests is key to sustainable development for people and forests.

Key words - Natural, Renewable resource, Ecological security, Livelihoods, Forest, Joint Forest Management, Sustainable development

INTERCROPPING: ROUTE OF SUSTAINABLE INTENSIFICATION * VINITA PARTE ¹, VISHNU K SOLANKI ¹, ANJANA KUJUR² AND J.S.RANAWAT³ ¹JAWAHARLAL NEHRU KRISHI VISHWA VIDYALAYA, JABALPUR, (M.P.), INDIA ²RVSKVV, GWALIOR (MP) AND ³HISAR AGRICULTURAL UNIVERSITY, HISAR, HARYANA

Intercropping is a farming practice involving two or more crop species, or genotypes, growing together and coexisting for a time. On the fringes of modern intensive agriculture, intercropping is important in many subsistence or low-input/resource-limited agricultural systems. By allowing genuine yield gains without increased inputs, or greater stability of yield with decreased inputs, intercropping could be one route to delivering 'sustainable intensification'. The improved understanding can guide approaches for improving intercropping systems, including breeding crops for intercropping. Although such advances can help to improve intercropping systems, we suggest that other topics also need addressing. These include better assessment of the wider benefits of intercropping in terms of multiple ecosystem services, collaboration with agricultural engineering, and more effective interdisciplinary research.

Key words: Intercropping, intensive agriculture, sustainable, breeding, engineering

HETEROSIS FOR GRAIN YIELD AND YIELD COMPONENTS IN POST RAINY SORGHUM GAWANDE S.M*., KALPANDE V.V., RATHOD S. T.

ALL INDIA COORDINATED SORGHUM IMPROVEMENT PROJECT, AKOLA CENTRE,

SORGHUM RESEARCH UNIT, DR. PANJABRAO DESHMUKH KRISHI VIDYAPEETH, AKOLA - 444001 (M.S.)

Fifty cross combinations were produced by crossing five lines and ten testers in line x tester design. In order to indentify the high yielding rabi sorghum hybrids, promising hybrids were sorted out based on positive standard heterosis for grain yield per plant. Total fifteen hybrids exhibited positive significant standard heterosis for grain yield per plant along with desirable significant standard heterosis for some of the component traits. For grain yield per plant, the top ranking hybrids based on standard heterosis were AKRMS-66-2A(38) x Rb-Local-1-1-sel-1 (31.89%) followed by AKRMS-66-2A(38) x SLR-137 (30.15%), AKRMS-66-2A(38) x Elangovan-35(28.30%), AKRMS-66-2A(38) x AKSV-370 (26.01%) and AKRMS-80-1A(39) x Rb-Local-1-1-sel-1 (25.93%).

Key words- average heterosis, heterosis, heterobeltiosis, standard heterosis, sorghum,

EFFECT OF ACETYLATION, HYDROXYPROPYLATION AND ACETYLATION-HYDROXYPROPYLATION MODIFICATION TREATMENTS ON THE PHYSICOCHEMICAL PROPERTIES OF HIGH, INTERMEDIATE, LOW AMYLOSE AND WAXY RICE STARCHES

SHAH ASMA IFTIKHAR¹, HIMJYOTI DUTTA², VINOD KUMAR MODI¹

¹AMITY INSTITUTE OF FOOD TECHNOLOGY, AMITY UNIVERSITY UTTAR PRADESH, NOIDA, INDIA

²DEAPARTMENT OF FOOD TECHNOLOGY, MIZORAM UNIVERSITY, INDIA

Acetylation, hydroxypropylation as single and acetylation-hydroxypropylation as dual modification treatments were applied to four rice starches distinctly varying in apparent amylose content of 27.2%, 22.7%, 9.8% and 0.3%. Introduction of acetyl and hydroxypropyl groups effected the physiochemical properties of all the starches. The degree of substitution, % acetyl and % hydroxypropyl groups were found to be within the range as recommended by the Food and Drug Administration. Changes in chemical bonding patters pre and post modification were studied by using FTIR. Values of thermal and pasting parameters were found to generally decrease after both single and dual modification. The lower pasting temperature and lower gelatinization amplifies their utilization in foods that are typically processed at low temperature. Both the modifications resulted in increased swelling power, solubility, freeze-thaw stability and light transmittance. Hydroxypropylated starches showed significantly higher freeze-thaw stability than native starches followed by acetylated and dual modified starches. No change in granular structure of starch was observed under SEM and no alteration in polymorphism detected in XRD graphs. Type-A crystallinity was retained after each modification.

Key words: starch, amylose, dual modification, acetylation, hydroxypropylation

INTER-STATE DISPARITIES IN AGRICULTURAL DEVELOPMENT- A WAY FORWARD FOR A SUSTAINABLE FUTURE PRIYANKA LAL, DARSHANABEN P MAHIDA, TULIKA KUMARI, BINITA KUMARI AND B.S. CHANDEL DEPARTMENT OF DAIRY ECONOMICS, STATISTICS AND MANAGEMENT

With increasing development in agriculture there arises question on its sustainability since the resources are limited and it is important to use resources without compromising the needs of future generation. Our government policies that aimed just to increase food production 50 years ago is now posing threat to our environment thereby is a slow poison for future. Development of agriculture is not the same as it seems to be, there is large disparities across states. Present study was attempted to construct an index for overall agricultural development

for major states and rank it based on its index. The index was constructed based on selected indicators; these indicators are not only of agriculture development of a state but also are important for sustainable agriculture point of view in the long run. PCA approach was used to develop an index. As per the index score, Haryana was the most developed state followed by Punjab whereas Chhattisgarh and Odisha were the least developed ones. The factors that contributed mostly to the agricultural development of a state were irrigation percentage, percapita milk availability, share of area under cereals and cropping intensity. Government policies should not only aim at improving parameters relating to crops but also improving the dairy sector for the overall development of agriculture. This would may away forward for a sustained growth of the sector by eliminating the inter-state disparities.

Key words: agriculture development, PCA, sustainable

HORTICULTURE MISSION: AN APPROACH FOR HORTICULTURE DEVELOPMENT

SANJAY PRAJAPATI AND SHILPA RATHOD

DEPARTMENT OF FRUIT SCIENCE & PSMA, COLLEGE OF HORTICULTURE, SARDARKRUSHINAGAR DANTIWADA AGRICULTURAL UNIVERSITY, JAGUDAN, MEHSANA-384460

The importance of horticulture in enhancing the productivity of land, generating employment, improving economic condition of the farmers and entrepreneurs, enhancing exports and also providing nutritional security to the people is widely acknowledged. National Horticulture Mission (NHM) was launched under the 10th five-year plan in the year 2005-06. During the XI FYP, the Government of India assistance will be 85% with 15% contribution by the State Governments. NHM shall be implemented in all the States and Union Territories of India except the North Eastern States, Himachal Pradesh, Jammu & Kashmir and Uttaranchal (for which a separate Technology Mission for integrated development of horticulture exists) to promote holistic growth of the horticulture sector covering fruits, vegetables, root & tuber crops, mushroom, spices, flowers, aromatic plants, cashew and cocoa. The NHM's key objective is to develop horticulture to the maximum potential available in the state and to augment production of all horticultural products in the state. Mission mode horticulture development program is being implementing in all the districts of Gujarat. Integrated pack houses, cold storages, Mango and Banana ripening chambers, cold chain are the key elements of this Program. A huge investment is being made for establishment of 13 such infrastructures to enhance internal and overseas trade of horticulture commodities. Couple of good integrated pack houses, air cargo complex and Gama irradiation projects has been established by GAIC. More than 500 On-farm Pack houses, 15 Minimal Processing units, 15 Pre cooling units, 40 Ripening Chambers, 125 Cold Storages, 90 Grading, Sorting & Packing Units, 8 refer Vans has been supported. About 120 clod storages have been established with the financial support of NHM in the state and a storage facility of about 5 lakh Mt. For holistic growth of horticulture sector, Mission emphasizes on activities such as: Enhancing horticulture production (to double farmer's income), Strengthening nutritional security, Production of planting material, Vegetable seed production, Coverage of area with improved cultivars, Rejuvenation of senile orchards.

MITIGATING EFFECTS OF CLIMATIC CHANGE AND DEVELOPMENT OF STRESS TOLERANCE IN RAPESEED-MUSTARD

NEHA DAHIYA*1 AND RASHMI1

¹DEPARTMENT OF GENETICS AND PLANT BREEDING, COLLEGE OF AGRICULTURE, G. B. PANT UNIVERSITY OF AGRICULTURE & TECHNOLOGY, PANTNAGAR, UTTARAKHAND

Brassica is an important oilseed crop which is at third position after soybean and palm oil worldwide and providing 13% of the total world supply. It is major oilseed crops of India next to soybean, both in area and production and accounts for about 25% of total oilseed production. The optimum temperature for germination and seedling establishment of brassica is 26°c. Due to the climate change impact, high temperature and drought stress mainly affect the brassica crop, which causes significant reduction in production. Rapeseed mustard is much sensitive to climatic variables which could significantly affects its production. High temperature adversely affects rapeseed mustard by reducing pollen germination, pollen tube length and survival of seedling. The effects of heat stress at reproductive stage in mustard are more severe than at other growth stages. High temperature stress has severe effects on the silique and seed production but it has no effect on flower production. Low temperature also caused reduction in germination rate and seedling emergence of Brassica species. Temperature below the 10°C resulted in significant reduction in canola germination, cell wall thickness. Water insufficiency caused a decrease in the plant height which is related to decline in photosynthesis products resulted by water stress conditions which ultimately cause the plant not to attain its maximum genetic potential. Water deficit conditions results in a reduction in the number of silique/plant by shortening the flowering period, reproductive period and infertility of flowers and their abscissions observed that drought stress during flowering and silique formation stage resulted in the reduction of the number of silique/plant through severe flower and silique abscissions. Thus, it is crucial to develop seedlings stress tolerance rapeseed mustard varities to mitigate the losses occurring due to stress. Suitable screening methods need to be developed and tested so that more stress tolerant lines can be include in Brassica breeding programs. The physiological and biochemical responses to various stresses are active research areas and the molecular approaches are being adopted for developing stress tolerance in plant. Molecular approaches have included omics techniques and the development of transgenic plants through manipulation of target genes. Investigation of underlying molecular processes may provide ways to develop stress tolerant varieties. Thus, it has become a major concern for crop production worldwide; keeping in view raised stress it has become the need of hour to study the plant response and adaptation mechanisms underlying it to develop stress tolerant varieties to mitigate the climatic change.

SIGNIFICANCE OF NANO-FERTILIZERS ON CROP PRODUCTION AND SOIL HEALTH RAMETI JANGIR^{*1}, DIKSHA TAJANE ² AND KRANTI B. PATIL³ ^{*1}CSWRI, ARC, BIKANER-334006 ²DEPARTMENT OF AGRONOMY ³DEPARTMENT OF SOIL SCIENCE AND AGRICULTURAL CHEMISTRY N. M. COLLEGE OF AGRICULTURE, NAVSARI AGRICULTURAL UNIVERSITY, NAVSARI-396450, INDIA Fertilizers have an axial role in enhancing the food production in developing countries especially after the introduction of

Fertilizers have an axial role in enhancing the food production in developing countries especially after the introduction of high yielding and fertilizer responsive crop varieties. In spite of this, it is known that yields of many crops have begun to depression as a result of imbalanced fertilization and decrease in soil organic matter. Moreover, excessive applications of nitrogen and phosphorus fertilizers affect the

groundwater and also lead to eutrophication in aquatic ecosystems. The current challenges of sustainability, food security and climate change are engaging researchers in exploring the field of nanotechnology as new source of key improvements for the agricultural sector. Nano-fertilizers are the important tools in agriculture to improve crop growth, yield and quality parameters with increase nutrient use efficiency, reduce wastage of fertilizers and cost of cultivation. Nano-fertilizers are very effective for precise nutrient management in precision agriculture with matching the crop growth stage for nutrient and may provide nutrient throughout the crop growth period. Nano-fertilizers increase crop growth up to optimum concentrations further increase in concentration may inhibit the crop growth due to the toxicity of nutrient. Nano-fertilizers provide more surface area for different metabolic reactions in the plant which increase rate of photosynthesis and produce more dry matter and yield of the crop. It is also prevent plant from different biotic and abiotic stress. **Key words:** Carbon nanotubes, Nano-fertilizer, Nanoporous Zeolites, Nutrients Use Efficiency, Smart fertilizer

POTENTIAL AND PROMOTION OF *RHODODENDRON* AS MULTIPURPOSE AGRO-FORESTRY TREE FOR SUSTAINING HIMALAYAN AGRICULTURE AND LIVELIHOOD'S JATIN MALHOTRA¹,ISHU PATHAK² DEEPAK KHOLIYA³ & GANESH PANDEY⁴ STUDENTS^{1 & 2} AND FACULTIES^{3 & 4} SCHOOL OF AGRICULTURAL SCIENCE, GRAPHIC ERA HILL UNIVERSITY, DEHRADUN.

The main objective of planting the multipurpose trees in agro-forestry are for human food, fuel, fodder, timber, creating wind break & shelter belts, shade, checking landslides, soil and water conservation, nitrogen fixation, litter waste generation for mulching & farm yard manure, microclimate amelioration for land sustainability etc. The study reveals the potential and promotion of planting Rhododendron as multipurpose agroforestry tree, for sustaining hilly agriculture and development of micro, small and medium enterprises from its products to check migration. Rhododendrons are among the most popular Uttarakhand State flowering tree that adorn the hilly regions with fantastic and overwhelming flowers of different shades. It is the largest genus of the family Ericaceae as well as one of the largest flowering plant genera in Asia. It has three major species (Rhododendron arboreum, R. anthopogon and R. campanulatum) reported from the western Himalayas – R. arboreum is the predominating species found in the hills of Uttarakhand; from 1,500 to 3,500 m above mean sea level. Rhododendron trees grow wild in the Himalayan forests and the hillsides are spotted with their bright red flowers in March and April. Locals call it buransh and the flowers are used to make a healthy - although typically over sweetened - juice concentrate. The Main Incredible Health Benefits of Rhododendron Flower Juice are:- It Reduce inflammation, Curb allergies, Fight pain, Treat diabetes, Prevent cancer, Keep our heart healthy, Nourish skin etc. Focusing on the flower, various other value added products are now being manufactured from it such as wine, jam, jellies, health supplements, natural color dyes, perfumes and essential oils. Health beverages from Rhododendron are the rich source of secondary metabolites such as phenols, phenolic acids, flavonols and flavonoids. Its flowers contain anthocyanin and carotenoids as the major pigments. Despite of its nutritional and medicinal properties along with its other therapeutic values, it has presence of several antioxidants. The plain beverage has a slightly bitter taste, and is not much relished by consumers. New methods for preparation of Rhododendron Liquor (with light alcoholic beverages) and blended squashes mixed with other edible plants products have now been developed. This multipurpose tree promotion in Uttarakhand Hilly Agro-forestry plantations will sustain Himalayan agriculture, generate employment to restrict migration, and develop new products of *Rhododendron* for the world.

Key words: Multipurpose tree, sustainable, non-alcoholic beverage, value added products etc.

CHANGES IN PHYSICO-CHEMICAL PROPERTIES OF WATER AND SEDIMENTS IN LAKE NAINITAL AFTER FOUR DECADES

SANDEEP DUTT MAINDOLI* AND P.K. GUPTA

DEPARTMENT OF ZOOLOGY, D.S.B. CAMPUS, KUMAUN UNIVERSITY, NAINITAL-263 001

Lake Nainital lies at an altitude of 1937 m a s l in Kumaun Himalaya. It plays significant role in upliftment of socio- economic conditions of the hill people. It has been recognised as a National lake of India. The lake greatly impacts the climate of the area and thus attracts a large number of tourists every year. Through tourism, it has its major role in improving the economic conditions of the people of this area. Besides this, it provides livelihood to more than four hundred boatmen, who earn their living through boating. The present investigation was carried out between 2016- 2018 with the objectives to understand the changes which have occurred in physico- chemical properties of the water and sediments in last forty years of time. Many changes have occurred in the catchment area and inside the lake. I hypothesised that these changes might have impacted the physico - chemical properties of the water and sediments in the lake. The water temperature and pH did not vary considerably; however, water transparency and concentration of dissolved oxygen increased in last forty years. The concentration of phosphate- phosphorous was found to be markedly increased while the concentrations of ammonium- nitrogen and nitrate nitrogen showed decreasing tendency after forty years. Changes have also occurred in physico- chemical properties of the sediments. The colour of the profundal sediment has changed from dark black to light black or brown. The smell of the profundal sediment was similar to hydrogen sulphide and rotten eggs forty years back. During the present investigation such smells were not detectable in the profundal sediments. Importantly, the organic matter content was found to be reduced considerably in last forty years- during 2016-17 it ranged from 3.75 to 17.7 % against 17.9 to 28.2 % during 1977-1978. These changes have been attributed mainly to anthropogenic activities in the catchment, and hypolimnetic aeration being carried out in the lake.

STUDY ON ATTITUDE OF POST GRADUATE STUDENTS TOWARDS AGRICULTURAL EXTENSION ADE ANIL, SAWANDKAR DIPALI AND NIGADE DHANSHRI

DEPTT. OF EXTENSION EDUCATION, COLLEGE OF AGRICULTURE, PARBHANI, M. S.,

Present study was carried out in Navsari Agricultural University, Navsari district of South Gujarat on year of 2011. The main objective of this study was to find out attitude of post graduate students towards agricultural extension. The study conducted on registered post graduate students selected from N. M. College of Agriculture and ASPEE College of Horticulture and Forestry, Navsari. The post graduate students of different disciplines were considered as respondents. Total 100 post graduate students were in all the size of sample for the present study. The "ex-post facto" research design was used for this study. A structural interview schedule was designed for collecting the data. This study concluded that, majority (58.00 per cent) of the post graduate students had moderately favourable attitude towards agricultural

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extension, while 25.00 per cent and 17.00 per cent of the post graduate students were having highly favourable and less favourable attitude towards agricultural extension.

Key words: Attitude, Extension, Post graduate students, etc.

DEVELOPMENT OF WEATHER BASED EPIDEMIOLOGY STUDIES ON ALTERNARIA ALTERNATA CAUSING ALTERNARIA BLIGHT OF TOMATO

RATAN LAL SHARMA*, R.R. AHIR, R.P. GHASOLIA, G.S. RATHORE AND PINKI SHARMA

DEPARTMENT OF PLANT PATHOLOGY, S. K. N. COLLEGE OF AGRICULTURE (SKNAU), JOBNER, JAIPUR 303 329

Alternaria blight of tomato caused by *Alternaria alternata* has become an important constraint to the growers of tomato in Rajasthan. The severity of this disease has been increasing day by day for last few years in Rajasthan due to changes in environment. The field experiment was carried out to understand the development of alternaria blight on tomato with respect to weather conditions during *zaid* 2017 and 2018 at SKNAU Jobner (Jaipur). Results showed that maximum temperature (r= 0.9032in 2017 and 0.8893 in 2018), minimum temperature (r=-0.8590 in 2017 and 0.8512 in 2018), relative humidity maximum (r=-0.6184 in 2017 and -0.8562 in 2017), relative humidity minimum (r=-0.6840 in 2017 and -0.5477 in 2018) and rainfall (r=-0.6161 in 2017) had strong negative and significant correlation with disease severity index (DSI). The mean minimum and maximum temperature during this period ranged from 15.63°C to 35.74°C and 15.75°C to 36.24°C during 2017 and 2018 respectively. The mean relative humidity ranging from 25.33 to 63.00 and 16.66 to 58.00 per cent was favourable for the disease development. The coefficient of multiple determinations (R²) was 74.50 and 92.40 per cent during 2017 and 2018, respectively. **Keywords**: Tomato, Alternaria blight, Correlation, Regression, Epidemiology, Weather parameters.

EPIDEMIOLOGY AND MANAGEMENT OF ALTERNARIA BLIGHT OF TOMATO (SOLANUM LYCOPERSICUM L.) RATAN LAL SHARMA, R.R. AHIR AND PINKI SHARMA

DEPARTMENT OF PLANT PATHOLOGY, S. K. N. COLLEGE OF AGRICULTURE (SKNAU), JOBNER, JAIPUR 303 329

Tomato (Solanum lycopersicum L.) is the world's second most consumed vegetable after potato. Alternaria blight of tomato caused by Alternaria alternata is one of the most important fungal diseases prevalent in tomato growing areas of India including Rajasthan and is considered as one of the limiting biotic factors for successful cultivation of tomato. Typical disease symptoms were angular brown spots with concentric rings and surrounded by discolored tissues. Disease intensity varied from 46.63 to 55.75per cent in four surveyed districts of Rajasthan. Maximum disease intensity was recorded in Jaipur (55.75%) and minimum in Tonk (46.63%). Alternaria alternata isolated from infected samples of tomato leaves, purified and its pathogenicity was proved. The pathogen produced dark brown to black colony with septate mycelium and acropetal chain of ellipsoidal brown or muriform conidia. Significant morphological, cultural and pathogenic variability were observed among eight isolates of A. alternata collected from Jaipur, Alwar, Dausa and Tonk districts. Among these, both isolates of Jaipur were found more virulent followed by Alwar isolates. Rate of disease progression was significant and positively correlated with maximum and minimum temperature and negatively correlated with maximum and minimum relative humidity during 2017 and 2018.Maximum disease intensity was recorded on 49 days old plants (63.35 %) followed by 42 days old plants (60.00 %). Maximum growth of A. alternata was observed at 90 per cent relative humidity (88.70 mm) and 25°C temperature (90.00 mm). Among seven nutrients tested, copper sulphate gave maximum inhibition of mycelial growth (52.22 %) at all concentrations. In field experiment, two sprays of copper sulphate (0.5 %) was found most promising in reducing the disease intensity (46.94 %) and increasing yield (45.52 %). Among seven plant extracts tested, Allium sativum clove extract gave maximum inhibition of mycelial growth (96.70 %) at all concentrations. In field experiment, two sprays of Allium sativum clove extract (10 %) at 15 days interval from disease initiation, was found most promising in reducing the disease intensity (58.16 %) and increasing yield (55.35 %). Among seven fungicides tested, hexaconazole gave maximum inhibition of mycelial growth (98.81 %) at all concentrations. In field experiment, two sprays of hexaconazole(0.2 %) at 15 days interval from disease initiation, was found most promising in reducing the disease intensity (79.74 %) and increasing yield (88.51%). Under artificial inoculation condition, out of twenty one varieties only Switizerland and Angour Lata were observed to be resistant against Alternaria blight.

Key words: tomato. Alternaria alternata, Epidemiology, Management.

BIOCHEMICAL FACTORS ASSOCIATED WITH RESISTANCE TO SPOTTED POD BORER, *MARUCA VITRATA* (FABRICIUS) IN GREEN GRAM SAMEER KUMAR SINGH*¹ P. S. SINGH² AND ALOK KUMAR SINGH³ COLLEGE OF AGRICULTURE, ACHARAYA NARENDRA DEVA UNIVERSITY OF AGRICULTURE AND TECHNOLOGY, KUMARGANJ, AYODHYA-224229, (U.P.) INDIA

A study on the role of biochemical factors associated with resistance to spotted pod borer, *Maruca vitrata* (Fabricius) in green gram was carried out at Agricultural Research Farm, Banaras Hindu University, Varanasi during *Kharif* 2014 and 2015. The biochemical factors like protein, total sugar, phenol and total chlorophyll were estimated. The maximum protein content was found in genotype IPM 306-6 (36.17 mg/g) and minimum in genotype PM-5 (20.53 mg/g). Highest total sugar content was reported from genotype ML 1256 (16.71 mg/g) and lowest total sugar content recorded in PM-5 (10.94 mg/g). The phenol content in genotype PM-5 (9.00 mg/g) was significantly higher than others whereas, the minimum phenol content was reported in IPM 306-6 (5.14 mg/g). The higher amount of total chlorophyll content found in genotype IPM 306-6 (3.33 mg/g) and lowest in PM-5 (1.85 mg/g). The significant and positive correlation was observed between *M. vitrata* larval population, pod damage and protein (r=0.954** and r=0.952**, respectively) and total sugar content (r=0.986**, respectively) and total chlorophyll content (r=0.994** and r=-0.993**, respectively) in immature pods, while, the significant and negative correlation was found between phenol (r= -0.987** and r= -0.984**, respectively).

Key words: - Green gram, biochemical factors, *Maruca vitrata*, genotypes and resistance.

STUDY OF METHANOL EXTRACT OF *MOSLA DIANTHERA* MAXIM. (MINIATURE BEEFSTEAK PLANT) FOR ITS PHYTOCHEMICAL ANALYSIS, HERBICIDAL AND ANTIFEEDANT ACTIVITY AGAINST *SPILOSOMA OBLIQUA* (WALKER) LARVAE

JEEWANTI KANYAL¹**, OM PRAKASH^{1*}, RAVENDRA KUMAR¹, D. S. RAWAT², R. M. SRIVASTAVA³ AND A. K. PANT¹ ¹DEPARTMENT OF CHEMISTRY, COLLEGE OF BASIC SCIENCE AND HUMANITIES, G. B. PANT UNIVERSITY OF AGRICULTURE AND TECHNOLOGY, PANTNAGAR, U.S. NAGAR- 263145, UTTARAKHAND, INDIA

²DEPARTMENT OF BIOLOGICAL SCIENCES, COLLEGE OF BASIC SCIENCE AND HUMANITIES, G. B. PANT UNIVERSITY OF AGRICULTURE AND TECHNOLOGY, PANTNAGAR, U.S. NAGAR- 263145, UTTARAKHAND, INDIA ³DEPARTMENT OF ENTOMOLOGY, COLLEGE OF AGRICULTURE, G. B. PANT UNIVERSITY OF AGRICULTURE AND TECHNOLOGY, PANTNAGAR, U.S. NAGAR- 263145, UTTARAKHAND, INDIA

Medicinal plants are the important element of indigenous medical systems in all over the world. Over the centuries societies around the world have developed their own tradition to make sense of medicinal plants and their uses. *Mosla dianthera* (Buch.-Ham. ex Roxb.) Maxim. is an important medicinal plant of the family Lamiaceae. The aerial part of the plant was subjected for extraction in methanol by Soxhlet apparatus. The chemical composition was analyzed by GC- MS instrument which led to the identification of 43 constituents contributing 78. 3 % of the total extract. Thymoquinol (12.9 %), 3-hydroxy-2,3-dihydromaltol (7.0 %), 3,5-dimethylanisole (6.5 %), palmitinic acid (6.2 %), and *D*-allose (5.6 %) were found as the major constituents in the extract along with a good amount of total phenolics, flavonoids and orthodihydric phenols. The herbicidal activity of the extract was studied by using the seeds of radish (*Raphanus sativus*) as a test plant. Different concentrations of extract of *Mosla dianthera* were applied on the test plant and the total seed germination was evaluated after the 5 days of incubation. The extract exhibited good herbicidal activity (maximum at 5% concentration) in a dose-dependent manner. The antifeedant activity of the extract was evaluated by using leaf disc method in 'no-choice' situation against third instar larvae of *Spilosoma obliqua* (Walker) also known as Bihar hairy caterpillar which were reared on host the plant soybean. The extract exhibited significant antifeedant activity in a dose dependent manner. Maximum antifeedant activity was observed at 5 % of concentration. This study reveals that the methanol extract of *Mosla dianthera* could be used as a natural antifeedant and herbicides in the near future.

Keywords: Mosla dianthera, Thymoquinol, Herbicidal activity, Antifeedant activity, Spilosoma obliqua

TO ASSESS THE PSYCHOSOCIAL FACTORS AT WORK AND EMERGENCE OF STRESS RELATED RISK AMONG BANK EMPLOYEES

NEHA ARYA¹ AND SEEMA KWATRA²

¹DEPARTMENT OF FAMILY RESOURCE MANAGEMENT, COLLEGE OF HOME SCIENCE, G.B PANT UNIVERSITY OF AGRICULTURE AND TECHNOLOGY, PANTNAGAR

²DEPARTMENT OF FAMILY RESOURCE MANAGEMENT, COLLEGE OF HOME SCIENCE, G.B PANT UNIVERSITY OF AGRICULTURE AND TECHNOLOGY, PANTNAGAR

The working environment and the nature of work itself play an important role on the health and well-being of working people. In this scenario, psychosocial risks have attracted the attention of banking sector where work load and work demand is very high. Work-related psychosocial risks emerge from the design, content and management of work as well as its social context that can have a hazardous influence on employee's health and lead to stress at work. Thus the present study was planned to evaluate the psychosocial factors at work and emergence of risk among bank employees. The study was carried out purposively in selected public sector banks of Pantnagar and Rudrapur in Udham Singh Nagar District. A total of 90 employees were selected from 13 banks for collecting data. Questionnaire based Psychosocial factors was adapted for collecting data along with that work related stress was also assessed for bank employees. It was found that job design or job pattern was the main reason for stress among bank employees, factors like work overload, communication gap among colleagues and higher authority, role conflict with supervisor increased stress among employees. They were exposed to high job stressors such as overload, long working hours, repetitive task, deadline and time pressure and shortage of staff. It leads to mental stress among employees which affects their performance.

Keywords :- bank, burden, conflict, mental pressure, psychosocial factor, stress

EFFECT OF INTEGRATED APPLICATION OF NITROGEN FROM ORGANIC (FYM AND VERMICOMPOST) AND INORGANIC (UREA) SOURCES ON EMERGENCE OF SEEDLINGS, YIELD OF POTATO (*SOLANUM TUBEROSUM*. L) AND ITS RESIDUAL EFFECT ON SOIL.

ANJU KEISHAM¹, YUMNAM SANATOMBI DEVI², PUNABATI HEISNAM³ AND L. NABACHANDRA SINGH⁴ ^{1,2,4} DEPARTMENT OF AGRONOMY, CENTRAL AGRICULTURAL UNIVERSITY, IMPHAL ³DEPARTMENT OF AGRONOMY, CENTRAL AGRICULTURAL UNIVERSITY, PASIGHAT

A study was conducted during *Rabi* season 2011-12 at the Research Farm of CAU, Imphal , to determine the effect of integrated application of nitrogen from organic (FYM, vermicompost) and inorganic (Urea) sources on emergence , yield of potato (*Solanum tuberosum*. L) and its residual effect on soil. The treatment consisted of four levels of FYM and vermicompost (16, 12, 8 and 4 t/ha) and (2, 1.5, 1 and 0.5 t/ha) respectively and a control treatment. And inorganic form of nitrogen was applied in the form of urea at four levels (174, 130, 87 and 44 kg/ha). The experiment was laid in RBD with ten treatment combinations having three replications. Analysis of the result showed that application of FYM (16 t/ha) alone produced maximum % of emergence of seedlings (99%) while the lowest was produced in the control plot (85%). Maximum number of stolons (8.67) and highest tuber yield (171.1 q/ha) was recorded in the treatment where urea (130 kg/ha) was integrated with FYM (4 t/ha) followed by integrated application of urea (130 kg/ha) and vermicompost (0.5 t/ha) producing 8.02 and 152.38 q/ha respectively. Maximum available soil N and P content (476.75 and 364.64 kg/ha) was observed in the treatment where FYM 16 t/ha) was solely applied which was significantly higher than the control plot. There was reduction of available P content of soil in the control plot whereas maximum available P was obtained in the treatment where urea (44 kg/ha) was integrated with FYM (8 t/ha). Therefore integrated application of urea (130 kg/ha) and FYM (8 t/ha) could produce better crop performance and crop yield. However, it warrants further testing to give conclusive recommendations. **Key words:** Urea, farm yard manure, vermicompost

IPM : AN INNOVATIVE APPROACH FOR SUSTAINABLE PEST MANAGEMENT IN SOYBEAN YOGESH PATEL, M. S. RAGHUWANSHI, V.K. GARG AND I.M. KHAN

J. N. AGRICULTURAL UNIVERSITY, COLLEGE OF AGRICULTURE, GANJ BASODA, DIST : VIDISHA 464221 (M.P.) Integrated Pest Management is a sustainable approach for managing pest by combining biological, mechanical and chemical tool in a way that minimize economics, health and environmental risks . The soybean or soya bean *Glycine max* (L.) is recognizing as the 'Golden bean' or the 'Miracle bean' in the western world, because it has revolutionized the agricultural economy of the USA, during the early part of the 20th century. Madhya Pradesh is the leading state in soybean production known as the "soybean state". The area under soybean in Madhya Pradesh is 55.13% and production 52.58% of the total area and production in the country during the year 2008-09 (Ankit Jaiswal and L. B. Hugar 2011). Despite being the largest producer of soybean, however, per hectare yield of Madhya Pradesh (1077 kg/ha) is much lower than the average of world (2033 kg/ha). To avoid losses caused by these pests, scheduled application of chemicals and sub-optimal doses without regard to the pest density and damage potential, were practiced. Indiscriminate use of chemicals led to the problems like pest out break, development of resistance by pest species to insecticides, elimination of natural enemies, risk to human and animal health besides environmental pollution. Integrated pest management (IPM) is perceived as the only alternative to combat these problems (Rao *et al.*, 1999). The major component of IPM tool box are deep summer ploughing, use of resistant variety, avoid delay sowing, sowing with proper spacing, seed treatment with Rhizobiuam, PSB and Trichoderma, use of NPV, Bt and plant origin insecticide. Among these, use of resistant varieties, fungal pathogens, NPV, plant and animal origin insecticides are gaining more importance in recent years. These practices are not only ecofriendly but also economically viable and also suitable for small farmers.

Keywords: Agriculture, Soybean, IPM, Sustainable,

EFFICACY OF SOME INSECTICIDES FOR THE CONTROL OF PULP WEEVIL, *STERNOCHETUS FRIGIDUS* (F), (CURCULIONIDAE: COLEOPTERA)

SUSHMITA TH¹ AND KARTHIK R²

^{1,2}DEPARTMENT OF ENTOMOLOGY, COLLEGE OF AGRICULTURE, AAU, JORHAT PIN CODE: 785013

Mango (*Mangifera indica* L.) is one of the most versatile and delicious tropical fruits and have an outstanding flavour with a range of varieties as a member of the family Anacardiaceae. It is also known as the "King of Fruits". Over 175 species of insects have been reported damaging mango tree and out of all insect pests, the mango pulp weevil, *Sternochetus frigidus* is considered to be one of the most serious pests. Five insecticides viz., Flubendamide, Imidacloprid, Profenophos, Thiamethoxam and Fipronil were treated against mango pulp weevil. The lowest case of mean percentage infestation of mango pulp weevil was found in Flubendamide 480 SC @ 100g a.i/ ha with 13.33%. The maximum mean number of harvested fruits (20.33), mean number of healthy fruits (16.27) and mean percentage of healthy fruits (80.00%) was found in the treatment of Flubendamide 480 SC @ 100g a.i/ ha. The effect of the five insecticides with different dosages on the quality parameters of mango showed that the mean fruit length was in the range of 13.03 cm to 17.06 cm, the mean fruit weight from 333gm to 464gm and the Total Soluble Solid (TSS) from 12.7 to 15.6 Brix in the different insecticidal treatments. The cost benefit ratio of Flubendamide 480 SC @ 100 g a.i/ha which was found to be 2.90 which the highest among all the insecticides.

Keywords: Mangifera indica, Sternochetus frigidus, Flubendamide, mean percentage infestation

CRISPR/CAS9 SYSTEM A NOVEL TOOL FOR THE MANAGEMENT OF PLANT DISEASES

SHIVAM MAURYA¹, SAURABH DUBEY², SUNIL KUMAR³

¹DEPARMENT OF PLANT PATHOLOGY, SRI KARAN NARENDRA AGRICULTURE UNIVERSITY, JOBNER, JAIPUR, RAJASTHAN – 303328, INDIA

²DEPARMENT OF PLANT PATHOLOGY, G.B PANT UNIVERSITY OF AGRICULTURE AND TECHNOLOGY, PANTNAGAR, UTTARAKHAND

³DEPARMENT OF PLANT PATHOLOGY, SRI KARAN NARENDRA AGRICULTURE UNIVERSITY, JOBNER, JAIPUR, RAJASTHAN – 303328, INDIA

The focused on genome editing that objectives genomic successions in a site explicit way has as of late developed as a best biotechnological weapon for boosting resistance in plants against broad phytopathogens. Among different quality altering methods, quality focusing on eminently by CRISPR-Cas9 (Clustered Regularly Interspaced Short Palindromic Repeats) has richly stirred considerable energy among farming researchers since its disclosure in 2013. It is a reasonable, simple; efficient and quickly flourishing procedure that happens in nature as a prokaryotic safe framework and presents protection from remote attacking hereditary components, for example, plasmids and bacterial infections by intruppting good have pathogen association. The most significant preferred position of this strategy over other quality altering strategies is that it empowers exact genomic adjustments effortlessly and increasingly successful way, diminishing off target impacts and can likewise be fit for altering various genome site all the while. The CRISPR/Cas9 procedure offers the chances to revise the effector-target succession for keeping away from effector-target molecular correspondence and furthermore to alter effector-target advertisers for expanding the statement of objective qualities and consequently occupied with the obstruction procedure. Other than it's across the board job in infection and bacterial malady opposition, as of late its possibility in contagious sickness the executives has additionally been accounted for. The method showed plant obstruction massively by following up on the resistance parts and demonstrated as a brilliant and fundamental methodology for maintainable agribusiness. The CRISPR/Cas9 framework and its role in creating plant resistance.

Keywords: CRISPR-Cas9, genome modifications, disease resistance, sustainable agriculture

APPLECATION OF BIOINFORMATICS IN AGRICULTURE

KOMAL SHEKHAWAT¹ ANIL KUMAR¹ SWARNLATA KUMAWAT¹

¹DEPARTMENT OF GENETICS AND PLANT BREEDING, COLLAGE OF AGRICULTURE, SWAMI KESHWANAND RAJASTHAN AGRICULTURAL UNIVERSITY, BIKANER, RAJASTHAN, INDIA

Bioinformatics is an interdisciplinary field that develops methods and software tools for understanding biological data. Bioinformatics combines biology, computer science, information engineering, mathematics and statistics to analyze and interpret biological data. Bioinformatics has been used for *in silico* analyses of biological queries using mathematical and statistical techniques. Common uses of bioinformatics include the identification of candidates genes and single nucleotide polymorphisms (SNPs). Often, such identification is made with the aim of better understanding the genetic basis of disease, unique adaptations, desirable properties (esp. in agricultural species), or differences between populations. In a less formal way, bioinformatics also tries to understand the organizational principles within nucleic acid and protein sequences, called proteomics. DNA sequencing genome annotation, compare entire genomes, which permits the study of more complex evolutionary events, such as gene duplication, horizontal gene transfer, and the prediction of factors important in bacterial speciation, Comparative genomics, Pan genomics Genetics of disease, Analysis of mutations in cancer Analysis of gene expression, Analysis of protein expression Analysis of regulation, Microscopy and image analysis Protein localization and Nuclear organization of chromatin

Keywords : DNA sequencing, Microscopy, Nuclear organization

THEMATIC MAP OF MICRONUTRIENT USING GEO-INFORMATICS TECHNOLOGY HENA PRAVEEN¹, M.P. SINGH², S.S. PRASAD² SUNIL KUMAR¹ AND AJEET KUMAR¹ ¹DEPARTMENT OF SOIL SCIENCE AND AGRICULTURAL CHEMISTRY, BIHAR AGRICULTURAL UNIVERSITY, SABOUR, BHAGALPUR-813210, BIHAR, INDIA

²DEPARTMENT OF SOIL SCIENCE, DR. RAJENDRA PRASAD CENTRAL AGRICULTURAL UNIVERSITY, PUSA, SAMASTIPUR- 848125, BIHAR, INDIA

Remote sensing and GIS has emerged as an effective tool for micro level mapping of natural resources. Soil surveying and mapping provides information regarding nutrient availability in soils which forms the basis for the fertilizer recommendations for maximizing crop yields. The multi-micronutrient status map was also generated by integrating the individual micronutrient cation map in GIS (Sood et al., 2009). Spatial variability in properties that influence soil fertility such as DTPA extractable Cu, Mn, Fe, Zn, Hot water extractable soil boron in surface soils of 149 soil samples collected from the area Rajendra Agricultural University, Pusa Farm were quantified and the respective thematic maps were prepared. The thematic soil maps distribution of different micronutrient characteristics which were assigned appropriate classes - low, medium and high or sufficient /deficient. Thematic of soil map of DTPA extractable Cu ranged from 0.32-6.97 mg kg⁻¹ with mean value of 2.96 mg kg⁻¹, DTPA extractable Mn ranged from 3.58-13.82 mg kg⁻¹ with mean value of 0.91 mg kg⁻¹, DTPA extractable Fe ranged from 5.67 - 29.59 mg kg⁻¹ with mean value of 14.99 mg kg⁻¹ ,DTPA extractable Zn ranged from 0.02 - 3.94 mg kg⁻¹ with mean value of 0.91 mg kg⁻¹, Hot water extractable soil boron ranged from 0.09 to 0.55 mg kg⁻¹. The soils with low/deficient macro and micro nutrients should be fertilized with proper dose of the nutrients to maintain soil health and to increase productivity. **Keywords**: Remote sensing, GIS, Natural resource , Soil surveying , Spatial variability

SMALL FARMERS, EXISTING FARMING PRACTICE AND SOCIAL DEVELOPMENT: A SOCIOLOGICAL ANALYSIS DEEPAK SHRIVASTAVA

SMS KVK, BILASPUR, CHHATTISGARH

The present studied Small Farmers, Existing Farming Practice And Social Development: A Sociological Analysis carried out during the year 2003-2006 in bilaspur district of chhattisgarh state it is observed the non tribal respondents were educated up to 8th class followed by 23.12 per cent of the respondents who were educated up to 10th class. 16.25 per cent of the respondents were illiterate and 15.62 and 14.38 per cent of them of them were graduate/post graduate and had education up to 12th class respectively **Keywords**: Farmers, Farming Practice and education

FOOD SECURITY AND RURAL CONSUMERS' SELECTION OF FOOD ITEMS PRODUCED BY SELF-HELP GROUPS PRITISHRI PARHI,MONALISHA SAHOO, TRUPTI MOHANTY AND MANASHI MOHANTY 'DEPARTMENT OF HUMAN DEVELOPMENT & FAMILY RESOURCE MANAGEMENT, OUAT, BBSR

Food security exists when all people at all times have physical and economic access to sufficient safe and nutritious food to meet their dietary needs and food preferences for an active and healthy lives. Self help groups are involved in producing and marketing both food and non food items in their locality, thus contributing towards achieving food security for rural people in their operational areas. To study the knowledge and buying practices of rural consumers towards SHG produced food items.

To determine the factors influencing purchasing of SHG produced food items by the respondents consumers. Purposive sampling was done for districts and blocks and random sampling technique was done for selections of Panchayats, villages and 120 no. of respondents. Both para metric and non parametric statistics were used for data analysis. Consumer awareness for self help group products (food items) are good. Female members of the respondents have better knowledge. The consumer preferences of food items largely depends on the convenience in purchasing, the market place along with the additional services. Majority of the respondents buy food items in packed form. Maximum respondents strongly agree that reasonable and affordable price influence them to purchase SHG products.Since SHGs produce food items in their respective local areas it is somehow more accessible, preferable and affordable for the local rural consumers help in achieving food security the national goal at the moment.

EFFECT OF FOLIAR APPLICATION OF ORGANIC PRODUCTS ON GROWTH AND YIELD OF OKRA (ABLEMOSCHUS ESCULENTUS) IN INCEPTISOL. VILAS TAKANKHAR¹, MAHENDRA BORKAR AND PRASHANT KARANJIKAR

COLLEGE OF AGRICULTURE, LATUR VNMKV, PARBHANI

The field experiment was carried out to study the "Effect of foliar application of organic products on growth and yield of okra (*Abelmoschus esculentus*) in *Inceptisol* during *summer* season of the year 2018-19 at the Research farm of Krishi Vigyan Kendra, Tuljapur. The experiment was laid in randomized block design with three replications and variety Sahiba as a test crop along with nine treatments *viz.*, T₁- Control, T₂- RDF 100:50:50 NPK kg ha⁻¹, T₃-FYM @ 5t/ha, T₄- Panchagavya @ 3%, T₅- Jeevamruth @ 5%, T₆- Panchagavya @ 3% + Jeevamruth @ 5%, T₇- RDF + Panchagavya @ 3% T₈- RDF + Jeevamruth @ 5%, and T₉- RDF + Panchagavya @ 3% + Jeevamruth @ 5%. The results of field study revealed that, the growth and yield of okra were significantly influenced by foliar application of organic products (panchagavya and jeevamruth). The growth parameters *viz.*, plant height, number of branches, number of leaves plant⁻¹, number of fruits plant⁻¹ and dry matter of okra were significantly improved due to treatment T₉ (RDF + Panchagavya @ 3% + Jeevamruth @ 5% foliar spray). The weight of okra fruits were also increased significantly dur to T₉ (RDF + Panchagavya @ 3% + Jeevamruth @ 5% foliar spray) followed by

treatment T7 - (RDF + Panchagavya @ 3%).

Key words: Foliar application, Panchagavya, Jeevamruth and okra

A STUDY ON CONSUMER AWARENESS TOWARDS ADULTARATION OF DAIRY PRODUCTS (CURD AND PANEER)

MOHANTY TRUPTI¹, MALLICK SWAPNAREKHA¹., MOHANTY MANASHI¹, PATI PRASAD.KUMAR²

1-DEPT OF RESOURCE MANAGENT AND CONSUMER SCIENCE, COLLEGE OF COMMUNITY SCIENCE, ORISSA UNIVERSITY OF AGRICULTURE & TECHNOLOGY, BHUBANESWAR-3

2-DEPT OF LIVESTOCK PRODUCTION & TECHNOLOGY, COLLEGE OF VETERINARY SCIENCE & ANIMAL HUSBANDRY, O.U.A.T, BHUBANESWAR-3

Introduction-Consequence of milk and dairy products adulteration are two-folds for the consumers: the economic loss by paying more for lower quality food as well as health hazards. Hence importance of consumer awareness and food safety techniques is a major concern. To know the awareness among consumers towards adulteration of dairy products(curd and paneer) and the adulterants present in the products. Survey method for collection of Primary data and Secondary data(physiochemical parameters) Experimental method: to determine the common adulterants. present in the dairy products (local sweets stall+co-operatives+vendor), Sample design-Purposive sampling and random sampling. Sample size-80. It was observed that socioeconomic variables like education ,income and occupation of respondents were significantly related to buying practices and knowledge level of respondents towards adulteration of dairy products ... All categories have the concept that "only addition of foreign substances" means to adulteration and main reason was "to fetch more income". Maximum were aware that, "Adulteration causes harmful effect on human heath" Ranked-1, but the Gap Percentage was maximum (47.66%) ,with regards to their knowledge on Food Adulteration Act and redressal mechanism(Gap Percetage62.66%), which indicated the importance of creating awareness among the consumers... Comparative evaluations of different available brands shows Omfed Brand plain curd has higher protein contents 6.6gm/100gms and Milky Moo brand of packed paneer contains highest 20.78gm/100gm of Protein and calcium as 501.06mg/100gm. Starch and skim milk powder are the common adulterants practiced by the local sweet stalls (more than 71.4%) for curd and paneer ,to increase volume ,thickness and taste. Consumers are not informed consumers. Hence consumer education and protective services must be strengthened by Govt and Non-Govt Organization.

Keywords-Adulteration, Consumer's Buying Practices, Knowledge, Awareness

PHYLLOCHRON: AN IMPORTANT TRAIT FOR ACCLIMATIZATION TO LOW TEMPERATURE IN CEREALS

BASANT KUMAR DADRWAL¹, PREETI SINGH² AND <u>VIJAI PANDURANGAM¹*</u>

¹DEPARTMENT OF PLANT PHYSIOLOGY, INSTITUTE OF AGRICULTURAL SCIENCES, BANARAS HINDU UNIVERSITY, VARANASI, UP, INDIA.

²DEPARTMENT OF CROP PHYSIOLOGY, COLLEGE OF AGRICULTURE, ANDUA&T, KUMARGANJ, AYODHYA UP

Phyllochron is an intervening period between the sequential emergences of leaves on the main culm of a plant also known as the reciprocal of leaf appearance. The interval between leaf appearances can be recorded in both standard measurements of time as well as thermal time e.g. growing degree units. Study of Phyllochron is a suitable method to understand the plant vegetative growth in better way and helps in simulation of plant growth and used for growth modeling. Also, it is a basal parameter which helps in predicting plant total leaf number as well as the date of flowering. Many cereal crops are cold sensitive species but having a capacity for acclimation to low temperature. The phyllochron is shorter in temperate environment than in a tropical and sub-tropical environment among the cereal crops. Typically, a maize phyllochron is 30% greater in tropical than in temperate areas. Thermal interval for leaf appearance is very critical for predicting the duration of vegetative growth development. The objective of this study was to check the response of phyllochron to environmental factor *i.e.* low temperature and determine its stability among maize inbred lines during its vegetative stage, which gives accuracy to predict phenology. While mean temperature was one of the factors that affected phyllochron, it was observed that availability of photosynthates is another factor which can bring about changes in phyllochron. The amount of photosynthates available for synthesis of new leaves determines the rate of production of leaves and ultimately the number of leaves formed in a plant. Also, plants generally have very limited stored carbohydrates for re-mobilization during the canopy formation period. The availability of photosynthates in turn depends on the rate of phyllochron as during periods of low temperature the level of irradiance available to the plant. Hence, the level of irradiance also affected the phyllochron as during periods of low temperature helevel of irradiance available to measure during the canopy f

Key words: acclimation, phyllochron, maize, temperature, photosynthates, irradiation

POTENTIAL OF INTEGRATED MULTI-TROPHIC AQUACULTURE (IMTA) IN FRESHWATER CULTURE SYSTEM: A MODERN APPROACH

*RITESH CHANDRAVANSHI, NEELMANI, B. NIGHTINGALE DEVI, ABHINEET SINGH

COLLEGE OF FISHERIES, CHHATTISGARH KAMDHENU VISHWAVIDYALAYA, KAWARDHA

With the increasing population, the demand of aquatic food increases. In view of declining per capita land and water availability, intensification of aquaculture primarily to the feed-based system, that can cause several negative impacts of surrounding environments,

stress and poor growth of farm fish as well as low profit margin. So, at present, Integrated multi-trophic aquaculture (IMTA) has the potential to achieve these sorts of problems by cultivating fed organisms (finfish) is combined with the culture of organisms that extract either dissolved inorganic nutrients (Aquatic plants) or particulate organic matter (shellfish) and, hence, the biological and chemical processes at work are balancing each other. We will discuss about the concept, types of sub-system, selection criteria of species and potential of IMTA is freshwater.

Key words: IMTA, fed organisms, finfish, inorganic nutrients, aquatic plants, shellfish, freshwater

COMBINING ABILITY AND MICROSATELLITES IN PIGEON PEA CHARU BISHT*, SK VERMA , AMIT KUMAR GAUR DEPARTMENT OF GENETICS AND PLANT BREEDING , GBPUAT, PANTNAGAR

Pigeonpea [Cajanus cajan (L.) Millspaugh] is the second important pulse crop in India. It is a versatile food legume crop which has diversified uses for vegetables, food, fodder, fuel and for construction of thatched shelters. It is an important source of protein and vitamin B. Pigeonpea productivity has remained low due to lack of intensive breeding efforts, poor plant type, poor crop management and prevalence of different biotic and abiotic stresses. The present investigation was carried out to identify the promising single cross hybrids in pigeonpea based on combining ability and heterosis analysis for seed yield and yield contributing characters and to assess the molecular diversity for fusarium wilt among some elite pigeonpea genotypes using SSR molecular markers at N. E. Borlaug Crop Research Centre, G. B. Pant University of Agriculture and Technology, Pantnagar. In present study, eight pigeonpea genotypes were crossed in all possible combinations in a half diallel fashion to produce 28 F₁'s during kharif 2016. A total of 37 genotypes comprising 8 parents, their 28 F₁'s (excluding reciprocals) and one check viz., Pant A 291 were evaluated in a randomized complete block design with three replications during kharif 2017. The analysis of variance was found significant for all the characters studied. The analysis of variance for combining ability indicated that both the additive and non-additive gene action were important for the expression of different traits. The estimates of σ^2 SCA were found higher than the σ^2 GCA indicating a very good prospect for the exploitation of non-additive genetic variation for all the characters studied. Among the parental lines Pant A 441, Pusa 992 and AH 09-471 were ranked as the best parents as they had good GCA for different yield attributes including seed yield per plant. Based on SCA effects, the hybrid Pant A 441 × Pusa 2013-2 was identified as the potential cross that is expected to produce good transgressive segregants in advanced generations. The nature and magnitude of heterosis revealed that high heterosis for grain yield was mostly accompanied by major yield contributing traits. For seed yield per plant, crosses Pant A 441 × AH 09-47 and Pant A 441 × Pusa 2013-2 were found most heterotic over the check Pant A 291. Molecular diversity analysis for fusarium wilt was carried out using 21 SSR markers, out of which 10 markers showed polymorphism. Molecular diversity analysis revealed that SSR markers showed high amount of polymorphism, more number of alleles per primer and a wide range of PIC value. Nineteen genotypes were grouped into two major clusters in dendrogram constructed based on SSR marker analysis. Keywords; marker, ssr, pic value, polymorphic, combining ability

SUSTAINABLE USE OF COAL IN KOLAGHAT THERMAL POWER PLANT IN WEST BENGAL, INDIA SOMNATH ADAK¹

¹DEPARTMENT OF GEOLOGY AND GEOPHYSICS, INDIAN INSTITUTE OF TECHNOLOGY KHARAGPUR

Coal combustion in power plants in India produces large quantities of coal related waste, mainly fly-ash and bottom-ash, in which naturally occurring radioactive materials (NORMs) are drastically enriched compared to those of feed coals. Since, our country depends largely on coal for its energy needs and the coals used in power stations are of high ash content, thus, improper management of fly-ash may introduce additional radioactivity to the surrounding environment and cause radiological risk. In the present work, an attempt has been made to assess the radiological impact of the Kolaghat Thermal Power Plant in West Bengal, India. The fly ash and coal from the power plant as well as soil and water samples from neighbouring area were analysed for 238U, 232Th and 40K by a NaI (Tl)-based gamma-ray spectrometer and High Purity Germanium (HPGe) γ -spectrometric analysis. Other geophysical surveys like, direct current (DC) resistivity survey, employing Schlumberger configuration, was undertaken to identify the local subsurface and to estimate the depth of contamination of groundwater around ash ponds and neighbouring area near the thermal power plant. Based on the surface radiation measurements and relevant ancillary data and GIS based modelling, expected radiation risk zones were identified with regard to the human population residing near the Thermal Power Plant. Also, remedial measures which could be adopted have been suggested.

Key words: fly-ash, radiological risks, gamma-ray spectrometer, direct current resistivity survey, GIS based modelling

ATTAINING FOOD SECURITY THROUGH PROMOTING CLIMATE SMART AGRICULTURE INTEGRATING SCIENTIFIC INTERVENTIONS & INFORMATION AND COMMUNICATION TECHNOLOGIES (ICTS) USHA DAS¹ AND M.A. ANSARI²

DEPARTMENT OF AGRICULTURAL COMMUNICATION, GBPUAT, PANTNAGAR, UTTARAKHAND

Climate change has emerged as one of the critical issues in development scholarship and debates globally. Impact of climate change on agriculture will be one of the major deciding factors influencing future food security as 5-30% decline in crop yield is predicted. There is an urgent need for enabling farmers to face the situation by transforming present agriculture into climate smart agriculture (CSA). International attention has led to the development of several CSA initiatives; however, there is a growing demand for approaches that comprehensively combine socio-economic and biophysical realities across scales in order to prioritize, implement and out-scale CSA technologies in different agro-ecosystems as flagged by FAO of the United Nations. And the importance of food security and climate change along with a better cleaner environment is further emphasised through Sustainable Development Goals (SDG 2nd, SDG 7 and SDG 13). Therefore, an integrated approach is needed to advocate scientific methods and interventions integrating Information and Communication Technologies (ICTs) for implementing CSA to attain Food and Environmental security. A systematic analysis of resilience, adaptation and to a great extent mitigation (pillars of CSA) which are ideally possible for a developing nation like India allows understanding adaptation; potential impacts of ICTs on such adaptive actions through e-Resilience and e-Adaptation. A future effort for grassroots adaptation of innovations can be strengthened through scientific interventions and use of ICTs will ensure widespread

reach at ground realities. ICTs are standing out here as a potential tool for integrating the potential key areas of climate change and effectively identifying the key enablers and drivers of CSA and constraints in using ICTs in context of climate change and food security. **Key words:** Climate Smart agriculture, Resilience, Food Security

EFFECT OF FOLIAR APPLICATION OF BORON AND GA₃ ON MORPHOLOGICAL AND QUALITY PARAMETERS OF GUAVA (*PSIDIUM GUAJAVA* L.) CV. LALIT"

SURBHI GOYAL¹, VIKAS MANDLOI², DEVENDRA VISHVKARMA³ AND BHARAT LAL⁴ ^{1,2,3}DEPTT. OF HORTICULTURE, COLLEGE OF AGRICULTURE GWALIOR

⁴DEPTT OF AGRICULTURE ENTOMOLOGY, COLLEGE OF AGRICULTURE GWALIOR

An experiment entitled "Effect of foliar application of Boron and GA₃ on growth, yield and quality of guava (*Psidium guajava* L.) cv. Lalit" was conducted at University guava orchard, Department of Horticulture, College of Agriculture, Gwalior during *Mrig bahar* at 2016-17. The experimental was laid out in the randomized block design with three replications and total treatment combination nine. Result based on investigation study revealed that the highest value of morphological parameters such as shoot length (20.79 cm), shoot diameter (4.40mm), No. of flower per shoot (23.31), fruit set (83.5%) and quality parameter fruit volume (202.78 ml), specific gravity (1.06) and T.S.S. (11.37 ⁰Brix) were recorded under interaction of treatment (B₂G₂) @ boron (0.4%)+GA₃ (100 ppm) at 90 Days. Conclude that the best treatment combination B₂G₂ with respect of morphological and quality parameters all three stage of guava. **Key words:** Mrig bahar, GA₃, and T.S.S.

MORPHOLOGICAL AND GENETIC DIVERSITY OF *FUSARIUM* SPP. ASSOCIATED WITH PANAMA WILT DISEASE OF BANANA IN BIHAR

RAM NIWAS*1, GIREESH CHAND², CHANDRASHEKHAR AZAD³

DEPARTMENT OF PLANT PATHOLOGY, BIHAR AGRICULTURAL UNIVERSITY, SABOUR, 813210, BHAGALPUR

The Bihar state play a most important role in the area and production of banana in India and the most of farmers are totally depends on the cultivation of those crops. In the current scenerio these crop suffers from a number of diseases caused by fungi, bacteria, viruses, nematodes, and also it is affected by abiotic factors. The present study was conducted in the Laboratory of Plant Pathology BAU, Sabour for evaluation of morphological and genetic diversity of *Fusarium* wilt of banana. After extensive survey in different banana growing area of Bihar, diseased sample were collected from Grande Naine cultivar of banana which is susceptible and successfully four isolates of *Fusarium* were isolated. The great variation were found in the size, shape of conidia, colony color, and sporulation pattern. The second experiment were conducted for genetic diversity *Fusarium* by using to primer ITS 4 and ITS 5. Un weighted Pair Group Method with Arithmetic Average (UPGMA) cluster analysis based on similarity cofficient showed that *Fusarium* isolates into one cluster with similarity value of 100% in PCR-RAPD of ITS4 and ITS5. The results these study indicate the *Fusarium* isolates were closely related to the banana and location.

Keywords: Banana, Morphological, Genetic, Diversity, Fusarium

IMPACT OF POLLINATORS/VISITORS ON POLLINATION ON FENNEL, *Foeniculum vulgare* (Mill.) CROP IN FAIZABAD AKSHAY KUMAR¹, RAM VEER¹, KRISHNA KUMAR² AND POPIN KUMAR³

¹DEPARTMENT OF ENTOMOLOGY, ACHARYA NARENDRA DEVA UNIVERSITY AGRICULTURE AND TECHNOLOGY, KUMARGANJ AYODHYA 224229 (U.P.)

²DEPARTMENT OF PLANT PATHOLOGY, ACHARYA NARENDRA DEVA UNIVERSITY AGRICULTURE AND TECHNOLOGY, KUMARGANJ AYODHYA 224229 (U.P.)

³DEPARTMENT OF PLANT PATHOLOGY, SARDAR VALLABH BHAI PATEL UNIVERSITY AGRICULTURE AND TECHNOLOGY, MODIPURAM MEERUT 250110 (U.P.)

Fennel, *Foeniculum vulgare* (Mill.) commonly known as *saunf*, is one of the most important winter season seed spices, grown in northern India. Fennel belongs to the family Apiaceae (Umbelliferae). Fennel crop is cross pollinated in nature. This experiment was conducted in Complete Randomized Block Design in the cropping season of 2017-2018 at Faizabad region, Utter Pradesh. Three different patterns of pollination i.e. pollination with honey bee (H), open pollination (O) and control without pollination (C) were tested for the seed set in fennel. Bees have many traits likes numerous body hairs, foraging behavior and feeding habits which makes them good pollinators. *Apis dorsata* was the most abundant visitors of fennel flowers i.e. 4.23 followed by *Apis cerana indica* 2.13 throughout the period of observation. The *Mesembrius bengalensis* 0.76, *Epasyphus balteatus* 1.68, *Coccinella spp.* 1.64 and *Polistes hebraeus* 1.28 were significantly lower than the *Apis dorsata*, *Apis floria* and *Apis cerana indica* 4.23, 1.85 and 2.13 respectively during 12:00 hours of the day were at par each other. Foraging behavior of different bee species on fennel flowers. It was that all the three bee species *viz.*, *Apis mellilfera*, *A. indica* and *A. dorsata* while foraging on fennel flowers were found to be top workers. *Apis dorsata* initiated foraging activity on fennel flowers little earlier in the morning and ceased its activity little later in the evening when compared with *Apis mellifera*, bee population was absent during 12:00-13:00 hrs. of the day due to high temperature (\geq 40) and humidity (\geq 60%). **Key words:** Funnel, Visitors, Pollination and Apis species

EFFECT OF INTEGRATED NUTRIENT MANAGEMENT ON SOIL PROPERTIES IN WHEAT CROP

¹CHANDRA SHEKHAR, VISHUDDHA NAND, PRASHANT SINGH AND MAHENDRA PRATAP SINGH ¹DEPARTMENT OF AGRONOMY, ACHARYA NARENDRA DEVA UNIVERSITY OF AGRICULTURE AND TECHNOLOGY, KUMARGANJ, AYODHYA-224229, (U.P.) INDIA

Wheat (*Triticum astivum* L) belongs to the family Poaceae. Wheat is an annual, self-pollinated long day winter cereal. Wheat species are *Triticum aestivum* (Hexaploid) and *Triticum durum* (Tetraploid). In India it is second important staple food crop, rice being the first. Wheat compares well with other important cereals in its nutritive value. It contains more protein than other cereals. It not clear what effects chicken manure might have on soil properties and yield of wheat crops. The objective of this investigation was to evaluate the effects of

different levels of chicken manure on soil temperatures, weed infestation, soil moisture content and yield of wheat. To compensate the supply and recent price hike in inorganic fertilizers, use of indogenous sources like farm yard manure should be encouraged as it supplies plant nutrient, improve the physical, chemical and biological properties of the soil and thereby increase the fertility and productivity of the soil. It has been recognized that the soil contain free living bacteria which are capable of fixing nitrogen non-symbiotically. The beneficial effect of *Azotobacter* on plant is associated not only with the process of nitrogen fixation and improved nutrition of plants but also with synthesis of complex biologically active compounds such as nicotinic acid, pantothenic acid, pyridoxine, biotin, gibberellins and other compounds which stimulate the germination of seeds and accelerate the plant growth under favourable environmental conditions. One month after sowing sorghum, determination of soil bulk density, total porosity and gravimetric moisture content was done at monthly interval on five occasions. Five undisturbed core (4cm diameter, 10 cm high) soil samples were oven-dried at 1000c for 24 hr. Total porosity was calculated from values of bulk density and particle density. Soil temperature was determined at 15:00 hr using a soil thermometer inserted to 5 cm depth.

Key words: Wheat, Azotobacter, Chicken Manure and FYM.

EFFECT OF PLANE OF NUTRITION ON GROWTH OF FEMALE BUFFALO CALVES.

NARENDRA KUMAR¹, DEEPAK SINGH, SHATENDRA KUMAR AND VIMAL KUMAR ¹DEPARTMENT OF ANIMAL HUSBANDRY AND DAIRYING CHANDRA SHEKHAR AZAD UNIVERSITY OF AGRICULTURE AND TECHNOLOGY, KANPUR 208002 (U.P.)

The present experiment conducted at university dairy farm during year 2016-17 at C.S.A. University of agricultural and technology Kanpur. Twelve female buffalo calves were selected for nutrient digestibility trial and divided in to three groups. Out of three groups one group was fed according to Morrison's (1948) feeding standard and served as control (T1), while the animal of other two groups were kept respectively at a concentrate mixture intake of 20 % below the Morrison's standard (T2) and 20 % above the Morrison's standard (T3). The average DM intake per 100 kg body weight was (4.01, 4.04, and 4.04 kg) the digestibility coefficient of DM were Recorded (60.21, 60.71, 60.48) and digestibility coefficient of CP (64.34, 64.35, 62.34) and digestibility coefficient of EE (60.83, 60.65, 61.59) and digestibility coefficient of CF. (57.67, 57.58, 56.27) and digestibility coefficient of NEE (64.46, 61.44, 63.12,). The average live Weight, Length, and heart girth, in female buffalo calves were increased (176.40, 186.65, and 215.40) gm per day. (1.25, 1.32 and 1.48) cm per week (0.83, 0.94, And 1.14) cm per week in T1, T2, and T3 group respectively, the parameters growth witch studied were statistically non significant. The group T3, was shown better performance in respect of Growth parameters in other groups T1 and T2 from the present study, it was Apparent that the extra concentrate to be added in died for proper development of growing calves T3 group were higher in growth than T1 and T2 groups. Digestibility coefficient of DM, CF, and NFE, were also higher in group T3.

BENEFITS OF GENETIC ENGINEERING IN AGRICULTURE

ANIL KUMAR¹, KOMAL SHEKHAWAT¹, SWARNLATA KUMAWAT¹

¹DEPARTMENT OF GENETICS AND PLANT BREEDING, COLLEGE OF AGRICULTURE, SWAMI KESHAWNAND AGRICULTURE UNIVERSITY, BIKANER-334006.

Genetic engineering, also called genetic modification or genetic manipulation, is the direct manipulation of an organism's genes using biotechnology with respect to agriculture, modern biotechnology has been considered as the second phase of green revolution. Some useful benefits of genetically modified plants in agricultural biotechnology are improved nutritional quality, better nitrogen fixation, disease resistant, plant enhanced efficiency of minerals used by plants to prevent early exhaustion of fertility of soil, reduced postharvest losses. The first genetically modified food was Flavr-Savr Tomato which was resistant to rotting. Another genetically modified food is golden rice (Pro Vitamin A enriched). Several other genetically modified foods include, soybeans, corn, cotton, seed oil etc have been formed. But many controversies are associated with genetically modified food including environment and human safety, ethics, food security, poverty reduction etc. Some success has been achieved in developing varieties resistant to herbicides, viral diseases and insect pest. Genetic engineering promises rapid acceleration of plant breeding efforts for crop improvement. **Keywords**: Genetic engineering, biotechnology, genetically modified.

NEUROPROTECTIVE EFFECT OF *TRIGONELLA FOENUM GRAECUM* (FENUGREEK) SEEDS AGAINST IMIDACLOPRID INDUCED TOXICITY IN WISTAR RATS

NAVEEN KUMAR, A. H. AHMAD, DISHA PANT, MANISH K. VERMA, POORNA C. PATWAL AND RAMANARAYANAN. S DEPTT. OF VETERINARY PHARMACOLOGY AND TOXICOLOGY, COLLEGE OF VETERINARY AND ANIMAL SCIENCES, G. B. PANT UNIVERSITY OF AGRICULTURE & TECHNOLOGY (GBPUAT), PANTNAGAR, UTTARAKHAND-263 145.

Trigonella foenum-graecum (Methi) seeds have been recognized by Asian and African folk medicine practitioners to manage diabetes, sexual disorders and degenerative diseases. Drugs of natural origin have gained more interest for the treatment of central nervous system disorders for their efficacy. Very few studies have reported the beneficial role of fenugreek in neuroprotection. The aim of this work was to study the neuroprotective effects of fenugreek seeds against imidacloprid toxicity in rat brain. Imidacloprid toxicity was induced by daily feeding, a dose of 500 ppm in feed. Aqueous extract of seeds of fenugreek (dose @ 12000 ppm in feed) was given alone, and with imidacloprid for the period of 90 days. Rats were offered *ad libitum* feed and water. At the end of experiment, all animals were scarified and biological analyses were performed. *In vivo*, fenugreek seed extract administration significantly influenced the acetylcholine esterase level in brain. A significant alteration of the antioxidant enzyme activities was also observed in fenugreek seed extract treated rats. These results indicate that the supplementation of feed with fenugreek seed is significantly effective in protecting the nervous system against imidacloprid induced toxicity. Thus, health promoting properties of fenugreek seed can help to improve both community health and the income of small and marginal farmers of the tropics.

Key word: Fenugreek, Trigonelline, Herbal Medicine, Neuroprotective, Imidacloprid.

INNOVATIVE APPROACH IN AGRICULTURAL AND ALLIED SCIENCE SMART FARMING TECHNIQUES SUNIL¹, DEEPAK LOURA2, AKSHIT RATHORE³, AMIT DHANKAR⁴

DEPARTMENT OF AGRONOMY, CCCSHAU, HISAR - 125004 HARYANA, INDIA

Agriculture is widest economic sector and plays an vital role in overall economic development of country. Increasing population of world needs more and more agricultural production. Most of the Indian farmers are small and marginal. Their average size of farm is less than 2 ha. There is also problems of urbanisation, desertification, salinisation, climate change and soil degradation. To meet current food demand and overcome such problems, advancements of technology is needed. Advancement of technologies with invention of Internet of Things (IOT) i.e. smarter technologies are substituting the traditional technologies resulting in wide range upgradation of the fields. Smart farming IOT is a novel design approach and most prominent farming technology that combines sensors and analytics to automate, moniter, or enhance and improve agricultural operations and processes. These smart technologies covers all features of precision agriculture and can be classified in data acquisition, data analysis and evaluation and precision application technologies. There are more than one thousand smart farming technologies. Each of these technologies is reported in term of where it can be used (which crops or cropping system, farm size), what advantage it will give to us (increased productivity, increased profitability, decreased soil compaction), and how it might be expected to be applied. In these technologies a remote controlled vehicle functions on both automatic and manual modes for various agricultural operations like spraying, cutting, weeding etc. The controller keeps monitoring the temperature, humidity, soil condition and accordingly supplies water to the field. These smart farming technologies allow superior and practical decision making to predetermine the best usage of water and other agricultural inputs including seeds, fertilizers etc. Some of these tehnologies are animal tracking, storage mapping, soil quality checking, auto irrigation, home gardening, NDVI based imaging, GPS based navigation etc. The combination of different technologies and their application towards certain area is always been a difficult task. The combination of rising tehnologies including ubiquitous computing, context aware computing and grid computing with sensor network can be implemented on agriculture domain to make agriculture smarter.

Keywords : Urbanization, Salinisation, Smart technology, GPS and Sensor.

EFFECT OF ELEVATED CO2 AND INSECTICIDE CHLORPYRIPHOS ON THE NITRIFICATION POTENTIAL OF RHIZOSPHERIC SOIL OF WHEAT

BHOOPENDRA SINGH¹, DR. AMITA SHARMA², MAHESH CHANDRA NAGAR³

DEPARTMENT OF ENVIRONMENTAL SCIENCE, COLLEGE OF AGRICULTURE GWALIOR, RVSKVV, GWALIOR (M.P.) Experiments were carried out to study nitrification in the rhizosphere of wheat under the influence of elevated CO₂, chlorpyrifos and biochar. The experimental factors were CO₂ (400 ppm, 800 ppm), biochar (0%, 1%), and chlorpyrifos (0 ppm, 10 ppm). The parameters were nitrification rate, abundance of 16S rRNA gene of eubacteria, abundance of amoA gene, plant shoot and root biomass. Nitrification was estimated by measuring soil NO₃-N during early vegetative growth of wheat. Experiment outlaid the impact of chlorpyrifos, biochar and climate factors on the nitrification activity in the rhizosphere of wheat. Soil was treated with chlorpyrifos at 10 ppm, biochar was amended at 1% w/w. The climate factor was elevated CO₂ (800 ppm). Soil was added with NH₄-N at 50 mg kg⁻¹ soil. Wheat seeds were sown in pots and plants were grown in a plant growth chamber under controlled condition (temperature and humidity). Nitrification was measured by estimating the NO₃-N concentration periodically. Abundance of 16S rRNA gene of eubacteria and amoA gene of ammonia oxidizing bacteria were estimated. Plant growth attributes comprising shoot weight and root weight were measured. Results highlighted that elevated CO₂ and biochar stimulated nitrification while chlorpyrifos inhibited nitrification. Microbial abundance varied in parallel with the nitrification. Among the factors the elevated CO₂ exerted maximum effect followed by chlorpyrifos and biochar. Nitrification was positively related with all parameters. Based on this experiment it can be concluded that the negative effect of chlorpyrifos on nitrification can be subsidized by elevated CO_2 and biochar addition. The elevated CO_2 acts as C fertilizer and increased root and shoot biomass. Probably, the high root exudates due to increased plant root biomass stimulated the eubacteria and ammonia oxidizing bacteria and nitification. Biochar was effective in regulating the negative impact of chlorpyifos due to its physico chemical nature. As predicted by IPCC the increasing atmospheric CO₂ is likely to have positive effect on nitrification in the rhizosphere of wheat. However, there is need of experiments considering the effect of rising temperature for a holistic understanding on the interaction of climate, biochar and chlorpyrifos on nitrification.

Key words: biochar, chlorpyrifos, rRNA, elevated CO2 rhizosphere and amoA gene.

EFFECTS OF SUBSOILER ON FARM FIELDS – A REVIEW RATHINAVEL S¹

DEPARTMENT OF FARM MACHINERY AND POWER ENGG., KCAET, THAVANUR, KERALA AGRICULTURAL UNIVERSITY, KERALA.

Due to modern mechanization technologies, numerous machineries invented and came for existence. As these machineries to be worked on farm fields frequently, a major problem of soil compaction occurs. Hence along with modern mechanization, an implement, the subsoiler plough famous for breaking hardpan beneath the soil and working at higher depths in farm fields was arrived. An overview of effects of subsoiler on farm fields was studied. In many cases the subsoiler has better performance on improving soil properties such as bulk density, porosity, strength, and infiltration rates. The subsoiling also has its effects on root system of plants positively. Most of the crop yields were seen positive or no correlation on subsoiling. Among the various methods of ploughing, annual ploughing with modified tynes, winged subsoilers are performing efficiently than the conventional one. On an economic point of view, fully irrigated lands, those lands without any hardpan, subsoiling is not recommended. As many of the crops shown positive outcome towards the subsoiling, it's recommended to be used in farm fields compulsorily for better yield and soil – water conservation on farm fields. In this chapter a worldwide detailed discussion is on effects of different methods of subsoiling, effects of subsoiling on root system, effect of subsoiler on crop yield. **Keywords**: Soil compaction, Subsoiling, Soil improvement, Root growth, Crop yield.

Global Perspective in Agricultural and Applied Sciences for Food and Environmental Security (GAAFES-2019)

TO STUDY THE POPULATION DYNAMICS OF BIHAR HAIRY CATERPILLAR (*SPILARCTIA OBLIQUA*) ON LINSEED, *LINUM USITATISSIMUM* (LINN.) AND THEIR RELATIONSHIP WITH ABIOTIC FACTORS

MOHAMMAD RIZWAN¹, MOHAMMAD IMRAN², MUZEEV AHMAD³

¹DEPARTMENT OF ENTOMOLOGY, SARDAR VALLABHBHAI PATEL UNIVERSITY OF AGRICULTURE AND TECHNOLOGY MEERUT (U.P.)

²DEPARTMENT OF GENETICS AND PLANT BREEDING, SARDAR VALLABH BHAI PATEL UNIVERSITY OF AGRICULTURE AND TECHNOLOGY, MEERUT (U.P.)

³DEPARTMENT OF HORTICULTURE, SARDAR VALLABHBHAI PATEL UNIVERSITY OF AGRICULTURE AND TECHNOLOGY MEERUT (U.P.)

The experimental trial was carried out at the student instructional farm of Narendra Deva University of Agriculture & Technology, Narendra Nagar (Kumarganj), Ayodhya. The site is located at 42 km away from the district head quarter, Ayodhya on Ayodhya -Raibareily road. The linseed genotype was sown in protected plot in Randomized Block Design with 3 replications. The plot size was 10x10 sqm. The sowing was done on the last November. In addition to this all normal recommended agronomical practices were followed. The meterological data was collected from the Department of Agrometerology, N.D.U.A.&T., Kumarganj, Ayodhya (U.P.) The study was carried out on the effects of various weather parameters like temperature (minimum and maximum), Relative humidity (%), Rainfall (mm) and Sunshine (hr) on incidence of Bihar hairy caterpillar (*Spilarctia obliqua*) on variety Neelum of linseed. The incidence of Bihar hairy caterpillar (0.335 and 0.586), relative humidity (0.086), rainfall (0.233) and sunshine hours (0.046), during *Rabi* 2012-13. The larvae of this voracious foliage feeder were recorded in the late vegetative stage of the crop during the last week of January and first week of March in Neelum. The peak in population 4.91 per plant was recorded in first week of March in variety Neelum during 2012-13.

Key words: Population Dynamics, Bihar Hairy Caterpillar, Linseed, Abiotic factors.

EFFECT OF APPLE POMACE POWDER ON A-AMYLASE INHIBITION AND GLUCOSE ADSORPTION CAPACITY

TARU NEGI¹, DEVINA VAIDYA²

DEPARTMENT OF FOOD SCIENCE AND TECHNOLOGY, DR. Y.S. PARMAR UNIVERSITY OF HORTICULTURE AND FORESTRY, NAUNI, SOLAN 173230

Apple is the most favoured fruit of millions of people. In India, apple processing industries are one of the major industries of Himachal Pradesh, Jammu and Kashmir and Uttarakhand for manufacturing of various products like juices, concentrate, wine, cider and canned slices etc. Apple pomace obtained after juice extraction from these industries is considered waste. Seasonal production and large quantity of apple pomace makes it difficult for the industries to dispose it timely and effectively. This pomace is dumped in the fields which creates a lot of pollution problem because of high fermentation and chemical oxygen demand. As the pomace is a part of fruit, it has potential for being converted into edible products and it is a rich source of carbohydrate, pectin, crude fiber, minerals and good source of nutrients. Apple pomace has a high content of total dietary fiber which is 35-60 per cent. It has versatile functional properties like α -amylase inhibition ration and glucose adsorption capacity. This property of apple pomace powder may be useful for lowering the glycemic index by its incorporation in foods with high glycemic index. Bakery products such as biscuit, cookies and cake are popular in India since the earlier times and constitute one of the most consumed foods in the world. In general, due to their richness in sugar and white flour, bakery products belong to medium-to-high glycemic index (GI) categories. It is possible to reduce the GI of bakery products by mixing wheat flour with other types of flours or grains or by adding fiber. Henceforth, we can use this industrial waste i.e. apple pomace in the bakery products to enrich it with fiber and therefore lower the glycemic index.

Keywords: apple pomace, crude fiber, α-amylase, glucose adsorption

COMPOST AND ITS ROLE IN AGRICULTURE

KAVITA¹, SEEMA¹, KAVINDER² AND HARENDER²

¹DEPARTMENT OF SOIL SCIENCE, CCS HARYANA AGRICULTURAL UNIVERSITY, HISAR 125004 ²DEPARTMENT OF AGRONOMY, CCS HARYANA AGRICULTURAL UNIVERSITY, HISAR-125004

Composting is eco-friendly and most effective means of recycling of organic waste, leading to a stabilized final product, free from pathogens that can be used as a fertilizer. Good quality compost having positive impact on soil health help in replenishing soil nutrient and optimum soil moisture content. Compost is beneficial to plants because as it is rich of nutrients and also act as soil conditioner. Composting of organic waste having advantage over direct application because it eliminates the pathogens and weeds, reduce volume of the organic waste, controls the odours, easy to store, transport and use. The benefits of application of compost divided into two groups: improve the crop productivity and profitability and improve the soil quality or soil health. In order to ensure safe application of compost, the standards laid down on the recommendation of Bureau of Indian Standard (BIS) in 2013. Acc. to these standards compost prepared from municipal solid waste having maximum bulk density should be 1.00, Arsenic (10.00 mg/kg), Cadmium (5.00 mg/kg), Chromium (50.00 mg/kg), Mercury (0.15 mg/kg) and Zinc (100.00 mg/kg) on basis of dry mass. EC of compost should be less than 4 dsm⁻¹. The pH should be neutral or within the range of 6.5 to 7.5. The compost should neither be completely dry nor be lumpy and moisture by mass 25%. The Nitrogen, Phosphorous and Potassium contents should be 0.8, 0.4 and 0.4% respectively. The Nitrogen should be in the form of Nitrates. The C/N ratio should be in between 15 to 20:1. Minimum total organic carbon by total dry mass should be 40%. As compost comes under the category of bulky organic manure its application to soil in large amount. This demerit of compost can be overcome by enrichment of compost, it is recommended that compost with a C/N ratio of about 20:1 should be treated with ammonium sulphate or urea so as to bring the C/N ratio to <10:1 and N content >2.5%. phosphorous enriched compost can be prepared by adding 5% super phosphates, dicalcium phosphates and rock phosphates at the time of filling of compost pits and this could raise the phosphorous content up to 5%. Key words: Compost, Benefits of composting, Quality parameters, Enriched compost

Global Perspective in Agricultural and Applied Sciences for Food and Environmental Security (GAAFES-2019)

INFLUENCE OF DIFFERENT INTERCROPPING SYSTEMS UNDER VARIOUS IRRIGATION REGIMES ON THE GROWTH AND YIELD OF GROUNDNUT (*ARACHIS HYPOGAEA* L.)

SYED ABUL HASSAN HUSSAINY¹, VAIDYANATHAN R² ¹DEPARTMENT OF AGRONOMY, TAMIL NADU AGRICULTURAL UNIVERSITY, COIMBATORE, TAMIL NADU, INDIA. ²PROFESSOR AND HEAD, OILSEEDS RESEARCH STATION, TAMIL NADU AGRICULTURAL UNIVERSITY, TINDIVANAM, TAMIL NADU, INDIA.

The suitability of intercropping system relies on the appropriate selection of companion crop and adequate irrigation application for both crops to sustain and bloom. In this regard, a field trial was conducted during *kharif* season of 2017 and 2018 to study the influence of groundnut (*Arachis hypogaea*) based intercropping system as influenced by different irrigation regimes on the peak growth and yield of groundnut. The intercropping systems included in the study were: sole groundnut, groundnut + castor, groundnut + blackgram, groundnut + sesame and groundnut + pearlmillet. Irrigations scheduled as IW/CPE ratio of 0.50, 0.75 and 1.0 were assigned. During the development stage groundnut intercropped with blackgram resulted higher in plant height (30.6 cm), number of branches/plant (6.12), leaf area index (3.12) and dry matter production (25.0 g/plant). Irrigation scheduling of IW/CPE ratio 0.75 significantly improved the growth of groundnut crop with higher plant height (29.5 cm), number of branches/plant (5.99), LAI (3.02) and DMP (24.2 g/plant). In terms of yield, pod yield of 6.96 g/plant with haulm yield of 14.6 g/plant during 2017 and 6.27 g/plant with 13.4 g/plant of haulm yield were recorded during 2018. Similarly, IW/CPE ratio of 0.75 recorded pod yield of 6.74 g/plant with haulm yield of 13.9 g/plant during 2017 and 6.04 g/plant with 12.6 g/plant of haulm yield during 2018 were recorded. From the study, groundnut + blackgram intercropping system with irrigation scheduling at 0.75 IW/CPE ratio during the *kharif* season enhances the growth and yield thereby increasing the productivity and profitability from the system.

Keywords: Groundnut intercropping, Irrigation scheduling, Pod yield, Haulm yield.

NATCA A POTENTIAL BIO-REGULATOR FOR FRUIT PRODUCTION: A REVIEW DEBASHISH HOTA¹*, SUDIPTA SOURAV SAHOO¹ AND AJAY KUMAR KARNA² ¹DEPARTMENT OF FRUIT SCIENCE, IGKV, RAIPUR

²DEPARTMENT OF FRUIT SCIENCE AND HORTICULTURE TECHNOLOGY, OUAT, BHUBANESWAR

N-acetyl thiazolidine 4-carboxylic acid is a new generation plant bio regulator which has been used in agriculture for substantial use. It is a mixture of organic amino acids which used as activator in horticultural crops, industrial crops, and tropical crops and fruit trees. It improves the metabolic activities of the crops and provides fastest recovery of the treated crops. It is also used as a fruit setter; bio stimulant germination enhancer, augmenting the vegetative growth, leaf chlorophyll formation and help in increasing yield potential of plant. It triggers plants to synthesize amino acids and hormones that are essential for normal functioning, growth and development of plants. In this paper we will study details about its mode of action, mechanism and response in fruit crops.

Key words: ATCA, Bio-Stimulant, Foliar application, CPPU

SITE DIRECTED MUTAGENESIS OF P-DOMAIN OF CALRETICULIN TRANSACYLASE: DEMONSTRATION OF LYS-207 AS THE POSSIBLE ACTIVE SITE RESIDUE RINI JOSHI

G.B.PANT UNIVERSITY OF AGRICULTURE AND TECHNOLOGY, PANTNAGAR

We have already established that lysine residues -206, -207, -209 and -238 in the P-domain of human placental Calreticulin (CR) undergoes autoacetylation during Calreticulin transacylase (CRTAase) catalyzed reaction utilizing acetoxycoumarin as the acetyl group donating substrate. In silico docking, suggested the involvement of lys-206 and lys-207 of P-domain of CR to play a pivotal role in binding the acetyl group donors. We caused the mutation at lysine residues of P-domain of CR, where lysine was replaced with alanine (K \rightarrow A). The three mutants of P-domain of CR were caused by site directed mutagenesis: P^{mut-1} (K -206, -209), P^{mut-2} (K -206, -207) and P^{mut-3} (K -207, -209). These mutants were successfully cloned in TA vector and then subcloned into pTrc His-C expression vector, as confirmed by sequencing of the clones. The clones of wild type P-domain (*P^{wt}*) and three mutated P-domain (*P^{mut-1}*, *P^{mut-2}* and *P^{mut-3}*) were expressed, followed by purification of mutated proteins using Ni-NTA affinity column. All the purified proteins were assessed for TAase activity to decipher the active site for acyltransferase function. Three mutations at lysine residues of P-domain of CR: K \rightarrow A, P^{mut-1} (K -206, -209), P^{mut-2} (K -206, -207) and P^{mut-3} (K -207, -209) were generated. The clones of wild type P-domain (P^{wt}) and three mutated P-domain (P^{mut-1}, M^{mut-2} and P^{mut-3}) were expressed and the recombinant *P^{wt}*, *P^{mut-2}* and *P^{mut-3}* proteins were screened for transacylase activity (TAase). The results revealed that *P^{wt}* and *P^{mut-1}* alone had TAase activity while *P^{mut-2}* and *P^{mut-3}* had none, highlighting lysine-207 of P-domain as the active site residue controling TAase activity.

SDS-PAGE BASED PROTEIN PROFILING AND DIVERSITY ASSESSMENT OF INDIGENOUSGERMPLASMS OF CUCUMBER (CUCUMISSATIVUS L.)

CHANDAN S. AHIRWAR¹ AND D. K. SINGH²

¹SCHOOL OF AGRICULTURE, ITM UNIVERSITY, GWALIOR (MADHYA PRADESH), INDIA- 474001, & ²DEPARTMENT OF VEGETABLE SCIENCE, G.B. PANT UNIVERSITY OF AGRICULTURE AND TECHNOLOGY, PANTNAGAR, (UTTARAKHAND), INDIA-263145

The objective of this study was to determine the relationships among genotypes categorization of seed storage proteins profiles of 44 genotypes with two checks Pant Khira-1 and Pointsetteof cucumber (*CucumissativusL.*) was performed by Sodium Dodecyl Sulphate Polyacrylamide Gel Electrophoresis (SDS-PAGE)at NAIP,Laboratory of Department of Vegetable Science, G.B. Pant University of Agriculture and Technology, Pantnagar, (Uttarakhand) during during July-October, 2014 and February-June, 2015. The entire profile comprised of 15 protein bands, distributed into three major zones A, B and C in increasing order of electrophoretic mobility i.e. Zone A was nearest and Zone C was farthest from the point of protein sample application. Among 15 bands maximum number of bands were observed in PCUC-193 (9 bands), PCPGR-6762 (8bands), PCPGR-7013 (8bands) and PCPGR-7795 (8bands) followed by PCUC-199 (7 bands), PCUC-832(7 bands), PCUC-44 (7 bands), PCUC-23 (6 bands). Minimum bands were shown by PCPGR-7795 (1 band).The

unweighed pair group method using arithmetic average (UPGMA) analysis of 46 cucumber genotypes was done and two major clusters obtained through seed protein analysis expressed better grouping of genotypes. **Key words:** Cucumber, SDS-PAGE, Similarity Index (S.I.) and UPGMA Cluster Analysis

MANAGEMENT OF ROOT-KNOT OF RICE BY SOIL APPLICATION OF CARBOFURAN AT DIFFERENT TIMES MUJEEBUR RAHMAN KHAN, TEHMINA ASHRAF AND SHUMAILA SHAHID

DEPARTMENT OF PLANT PROTECTION, FACULTY OF AGRICULTURAL SCIENCES, ALIGARH MUSLIM UNIVERSITY, ALIGARH-202002, U.P., INDIA.

The study was undertaken in infested pot soil to evaluate the effectiveness of soil application of carbofuran at different time schedules against *Meloidogyne graminicola* on six rice cultivars viz. Anjali, Abhishek, Hazari, Samba Mehsuri, Sugandh and Vandana. All the cultivars except Abhishek were found susceptible and developed characteristic terminal galls. The cv. Sugandh expressed highest degree of susceptibility, developed 57 galls/root system and exhibited 29 % decrease in the plant growth variables. The cvs. Samba Mehsuri, Hazari, Anjali and Vandana developed 28-38 galls/root system. These cultivars also supported the production of 20-30 egg masses leading to 60-90% increase in the soil population of *M. graminicola*. Soil application of carbofuran at 15th or 30th day of transplanting suppressed the galling, egg mass production and soil population of the nematode and improve the plant growth of rice cultivars, the effect being greater with the former. The study has revealed that soil application of carbofuran at 15th day can significantly control the root-knot and improve the plant growth of rice.

Key words: Meloidogyne graminicola, Oryza sativa.

PROXIMATE COMPOSITION AND SENSORY EVALUATION OF VALUE ADDED SNACKS (*MATAR*) PREPARED FROM WHEAT-BENGAL GRAM FLOUR AND SPIRULINA PLANTENSIS POWDER SEEMA^{1*}, SUDESH JOOD²

DEPARTMENT OF FOODS AND NUTRITION, I.C COLLEGE OF HOME SCIENCE, CCS HARYANA AGRICULTURAL UNIVERSITY, HISAR- 125 004 (HARYANA), INDIA

The aim of the study was to evaluate the effect of varying the proportions of composite flour on sensory properties of snacks (*matar*). Acceptable level of snacks was further evaluated for their proximate composition. Four types of flour were formulated from wheat-bengal gram flour and *Spirulina* in the ratio of 49:49:2 (Type-I), 48:48:4 (Type-II), 47:47:6 (Type-III) and 46:46:8 (Type-IV). 100 per cent wheat flour was used as a control. On the basis of result of sensory evaluation, Type-I snacks exhibited highest scores whereas, Type-IV snacks showed lowest scores. Control wheat flour snacks contained 2.25 per cent moisture followed by 2.82 per cent for Type-I, 3.15 per cent for Type-II and 3.46 per cent for Type-III *matar*. All proximate parameters (crude protein, crude fat, crude fibre and ash) were found to be significantly increased in all three types of supplemented snacks. High level of crude protein, fat, fibre and ash contents in supplemented snacks might be due to addition of bengal gram flour and *Spirulina* powder in wheat flour. Maximum content was observed in Type-III composite flour based snacks while minimum in Type-I composite flour made snacks. All types of snacks items differed significantly in their moisture, protein, fat, crude fibre and ash contents.

Keywords: Sensory evaluation, Value added, Composite flour, Proximate composition

PHYTOCHEMICAL ANALYSIS AND BIOLOGICAL ACTIVITIES OF ETHYL ACETATE STEM EXTRACT OF ARDISIA SOLANACEA ROXB.

BAHAAR ANJUM^{1*}, RAVENDRA KUMAR^{1*}, OM PRAKASH¹, R.M. SRIVASTAVA², A.K. PANT¹

¹DEPARTMENT OF CHEMISTRY, COLLEGE OF BASIC SCIENCE AND HUMANITIES, G. B. PANT UNIVERSITY OF AGRICULTURE AND TECHNOLOGY, PANTNAGAR, U.S. NAGAR-263 145, UTTARAKHAND, INDIA

²DEPARTMENT OF ENTOMOLOGY, COLLEGE OF AGRICULTURE, G. B. PANT UNIVERSITY OF AGRICULTURE AND TECHNOLOGY, PANTNAGAR, U.S. NAGAR-263 145, UTTARAKHAND, INDIA

The aim of present study was to analyze the chemical composition and to evaluate biological activities of the ethyl acetate stem extract of *A. solanacea*. The stem of *A. solanacea* was collected from Tarai region of Uttarakhand. Extract was obtained from the stem using Soxhlet method in ethyl acetate. The extract so obtained was chemically analysed qualitatively and quantitatively. Qualitative analysis of ethyl acetate stem extract of *A. solanacea* showed the abundance of alkaloids, carbohydrates, resins, diterpenes, triterpenes, fats and oils. While quantitative analysis of extract was done by the combination of GC and GC/MS. The major compounds present in the stem extract (ASSE) were 4,6,6-trimethyl-2-(3-methylbuta-1,3-dienyl)-3-oxatricyclo octane (16.19%), 3-hydroxy-3,7,11,15-tetramethylhexadecanoic acid silylat (10.55%) and palmitic acid (6.99%). ASSE showed good phenolic, flavonoid and orthodihydric phenol content. The *in vitro* antioxidant activity was performed in terms of DPPH radical scavenging, reducing power and metal chelating effect and showed good antioxidant effect by comparing with the standard antioxidant. ASSE (IB₅₀₌ 3.13±0.05) showed a strong *in vitro* anti-inflammatory effect relative to the diclofenac sodium. The antifeedant activity of ASSE was done against Bihari Hairy Caterpillar (*Spilosoma oblique*) insect and the results showed good % antifeeding ihhibition. The herbicidal ASSE was done against the radical length used to determine the effects of stem extract of *A. solanacea* on radish seeds. ASSE showed highest percent inhibition of seed germination, coleoptile length and the radical length with IC₅₀ value of $0.11\pm0.05\%$, $0.11\pm0.02\%$ and $0.12\pm0.04\%$ respectively.

Key words: Ardisia Solanacea, antioxidant, anti-inflammatory, antifeeding, herbicidal

DEFICIT IRRIGATION: AN ON FARM STRATEGY TO INCREASE WATER USE EFFICIENCY AND QUALITY OF FRUITS

KALPANA CHOUDHARY*, NIRMAL KUMAR MEENA, SONALI CHOUDHARY** AND SANDEEP KUMAR DEPARTMENT OF FRUIT SCIENCE,, COLLEGE OF HORTICULTURE AND FORESTRY, JHALARAPATAN CITY, JHALAWAR- 326 023 **YS PARMAR UHF NONI, SOLAN (HP) Deficit irrigation is advancement over traditional irrigation system in fruit crops. It is the process of irrigating which involves application of lesser amount of water to the crop as compare to its original water demand. In this, the irrigation water is provided to the crop in a controlled manner at critical stages of crop growth and development. Deficit irrigation techniques in fruit crops can reduce irrigation water requirement up to 50 per cent and increase WUE to the extent of 90 per cent with the improvement in quality. It improves quality of fruits through the biosynthesis of primary and secondary metabolites relevant for crop quality. Metabolic changes induced phytohormones (ABA and cytokinins), could be the result of higher conversion of starch to sugar and enhanced activities of enzymes involved in carbohydrate metabolism in the fruits. Stress results in little bit poor growth but increases the quality in terms of acidity, TSS, sweetness, antioxidants and shorten juvenile phase. Its usefulness has been proven in many fruit crops such as grapes, citrus, pomegranate, mango, apple and strawberry. It vividly appeared that deficit irrigation technique is worth adoption in view of increasing quality with better WUE. It has all merit of higher yield and quality per unit water consumed. In agriculture where 83 per cent of the total available water is used, adoption of such kind of technique is sure to curtail the requirement of water which is getting scarce day by day. **Key words:** *Deficit irrigation, stress, WUE, fruit quality*

COLD PLASMA TECHNIQUE (CPT): A NOVEL APPROACHFOR BETTER STORAGE LIFE OF FRUITS AND VEGETABLES

VAISHALI GUPTA, NIRMAL KUMAR MEENA, KALPANA CHOUDHARY AND INDRARAJ GHASIL COLLEGE OF HORTICULTURE AND FORESTRY, AU, KOTA, JHALARAPATAN, JHALAWAR,- 326 023 (RAJASTHAN)

Fruits and vegetables are mainly consumed as fresh form and demand is continuously increasing due to consumer consciousness for health. Fruits and vegetables are loaded with various micro-organisms which is concern of food safety. There are many techniques used to reduce this load like sterilization, pasteurization, use of sanitizers. Cold plasma techniques is emerging techniques to reduce microbial load. This is a non-thermal technique which uses cold gases at temperature below 40°C to sanitize fresh products, processed products or any other contaminated surface. Cold Gases could be normal air, nitrogen or noble gas mixture which may be ionized by electricity or lasers. This technique alters/ destroys cell membrane, internal cellular components and DNA strands of microbes with radicals, charged species and ultra violet radiations and thus it helps in extending the storage life of produce by reducing pathological loads, deactivation of enzymatic reaction. It is an eco- friendly approach which avoids the use of chemicals and leaves no residue. It has negligible impact on nutritional and sensory attributes of produce and that's how it is superior to conventional methods of preservation/ sanitization which have negative effect on sensory and nutritional attributes of produce. It is useful in sanitizing surface of apple, strawberry, blueberry, kiwi fruit, melon cherry tomato, carrot, cucumber etc. by cold ionized gases.

Key words: cold plasma; non-thermal; ultra violet; nutritional; sensory

PERFORMANCE OF *PONGAMIA PINNATA* ROXB. UNDER WATERLOGGING, SALINITY AND THEIR COMBINATION IN NURSERY ENVIRONMENT

SACHAN SHEPHALI¹, DAHAYAT ANKUR²

¹FOREST ECOLOGY AND CLIMATE CHANGE DIVISION, TROPICAL FOREST RESEARCH INSTITUTE, JABALPUR (M.P.)

²FOREST GENETICS AND TREE IMPROVEMENT DIVISION, TROPICAL FOREST RESEARCH INSTITUTE, JABALPUR (M.P.)

The world is facing severe and unpredictable challenges due to increasing abiotic stresses as a consequence of the earth's changing climatic conditions. The increasing waterlogging and salinity stress problems are the example of such disturbances caused in nature. In the present study, the effect of waterlogging, salinity and combined waterlogging & salinity stress on morphological, physiological and biochemical parameters along with protein profile of Pongamia pinnata at seedling stage under nursery conditions have been discussed. Pot culture experiments were conducted in factorial RBD design to observe the effect of waterlogging (W), salinity (S) and combined salinity & waterlogging (SW) stress on the selected seedling under nursery conditions for one year. Waterlogging stress condition was created by perforating the polybag at specific height with standard size and watered daily. Salinity was maintained at 8 dS/m salt concentration. The amount of water equal to the calculated field capacity was provided to each polybag. Total biomass and leaf area were measured in morphological parameters. Physiological parameters viz. photosynthetic rate and stomatal conductance of the seedlings were measured. Total chlorophyll, proline and protein content were estimated for biochemical analysis. Protein profiling of seedlings was performed by SDS-PAGE method. The outcome of the experiment showed that salinity treatment had major negative impact on biomass which can also observe in leaf area. Under waterlogging treatment, the seedling showed very appreciative avoidance and adapted behavior. The seedlings under salt + waterlogging managed to tolerate the combined stress condition which was opposite to deleterious impact of combined abiotic stresses. Two new bands observed under 8 dS/m S + W shows the involvement of protein in the tolerance behavior of seedlings. The plantations of suitable tree species in such areas will be helpful in sustainable forest management and resilient the forest ecosystem to climate change.

Keywords: Waterlogging, Salinity, Pongamia pinnata, Parameters, Protein

AN ECONOMIC ANALYSIS OF CUMIN IN INDIA – A TREND APPROACH NAVEEN KUMAR. P¹ DR. N K MEENA² ¹ DEPARTMENT OF AGRICULTURAL ECONOMICS, TNAU, COIMBATORE SUPERSIGNANTING DUNY DESIGNAL ADDUD. DATA STAN

²SURESH GYANVIHAR UNIVERSITY, JAIPUR, RAJASTAN

India is the largest producer, exporter and consumer of spices which contribute 48 per cent and 43 per cent share by volume and value. About 70 per cent of worlds cumin is produced in India. Now the Performance of Indian cumin is having considerable competitiveness in the international market. With this background the current study is to study the trend analysis Cumin area, production, productivity, to study the direction of trade in Cumin export and to suggest relevant policy measures to improve the export performance of Cumin. It is based on the secondary data and the analytical tools were used is Compound Growth Rate(CGR) analysis, trend analysis and Markov chain

analysis. The results indicated that the growth in area under cumin and production has shown increasing trend during study period. The direction of trade shows that the Vietnam, U.S.A and Other countries were more stable cumin importers from India while U.A.E and Brazil was less stable but the government of India should rejuvenate its market with less stable importing countries. Necessary steps have to be taken by the Government encouraging the exporters to maintain the Indian dominance in the world market. **Keywords**: Cumin, Markov chain analysis, export

ECOFRIENDLY RHIZOBACTERIAL BIOFILM TO PROMOTE GROWTH AND INDUCTION OF DEFENSE AGAINST BACTERIAL WILT OF CHILLI

ABHIJEET SHANKARKASHYAP*1, ²AND DINESH SINGH²

1. ICAR-NBAIM, MAU NATHBHANJAN UP-275103

2. INDIAN AGRICULTURAL RESEARCH INSTITUTE, PUSA NEW DELHI- 110012

Biofilms is well organized, cooperating community of microorganisms. Microbial cells affix to the surfaces and develop a biofilm that represent commixed group of microorganisms in which cells stick to each other within a self-engendered matrix of extracellular polymeric substances (EPS); however, their utility as biofertilizers cum biocontrol agent has not been plenarily explored. The present investigation was geared towards in vitro development of biofilms utilizing fungal mycelia (*Trichodermaviride*) as matrices and *Bacillus subtilis* as partners. The Indigenous rhizobacterial isolates from different geographical regions were evaluated for the growth promotion and protection of *Capsicum annuum* L.(Chilli) against wilt disease caused by *Ralstoniasolanacearum*. The total number of 48rizobacterial strains were assessed against *R. solanacearum*. The maximum antagonism was recorded by few strains and GC-MS analysis revels series of chemical compound were involved in antagonistic behavior of these stain, which are identified at molecular level as *Bacillus subtilis*.Growth promotion activities were assessed by screening siderophore (60% were found positive), HCN, ammonia, IAA and P solublization and Two best isolates were selected for developing Biofilm and is confirmed by using confocal microscopy. Rhizobacteria based biofilm treated seeds showed enhanced germination, shoot length, root length, dry weight, total chlorophyll, total biomass of chilli plants and reduced diseases incidence and had positive effect on biochemical parameters as compared to uninoculated control. The results indicated that the specific activity of defensive enzymes *viz*. peroxidase and polyphenol oxidase was significantly up-regulated from zero hours onwards after inoculation of *Ralstoniasolanacearum*.Biofilm basedbiofertilizers obviate the desideratum of developing combi- formulation of fungal and bacterial biocontrol agents which is cumbersome.

A STUDY ON ASSESSMENT OF SATISFACTION LEVEL OF STUDENTS HAVING COACHING IN INSTITUTES OF HISAR CITY

EKTA ROHILLA*AND KIRAN SINGH

COLLEGE OF HOME SCIENCE, CCS HARYANA AGRICULTURAL UNIVERSITY, HISAR-125004, HARYANA, INDIA

Coaching can make a difference in people's performance for three key reasons. It is customized to meet each person's needs, so no time is wasted. Although books, classes, e-learning, and other approaches may be less expensive, they may not provide as much value for the learner because they cover a broad content area and are aimed at a diverse audience. The present study was conducted in the Hisar district of Haryana state with the objective to assess the style of teaching of coaching instructor and to assess the student satisfaction level of their coaching institute. Results show that in personal variables the majority of the respondents were in 16-17 years of age. Most of the respondents were the female and the maximum number of respondents was lives in the nuclear family. The study also revealed that most of the respondents were studying in 12th class and maximum respondents said that they were preparing for banking competitive exams. **Keywords**: Satisfaction level; students; coaching; performance.

ORGANIC MANAGEMENT OF ROOT KNOT NEMATODE (*MELOIDOGYNE JAVANICA*) ON MUNGBEAN BY SOIL AMMENDMENTS OF POWDERED BOTANICALS VIJAY JOSHI¹, SATYA KUMAR² AND SHILPI RAWAT³

DEPARTMENT OF PLANT PATHOLOGY,G.B. PANT UNIVERSITY OF AGRICULTURE & TECHNOLOGY-PANTNAGAR, INDIA

Root-knot nematodes (*Meloidogyne spp.*) has emerged as a major threat throughout the world and it has occupied a place of 'National Pest' owing to its severity. This is a major constraint in successful mungbean cultivation leading to the significant loss to the pulse grower. Moreover, it paves entry and infestation to other opportunistic plant pathogens leading to disease complexes which ultimately causes high yield loss. The present study was conducted in glasshouse for the management of root-knot nematode (*M. javanica*) on mung bean plant by soil amendment through different powdered botanicals and its effect on various growth parameters. Botanicals (*Azadirachta indica, Carissa spinarum, Acorus calamus, Tagetes erecta, Tagetes patula, Calotropis procera,* and *Calotropis gigantea*) due to the presence of different nematicidal properties helped to increase the shoot length, root length, shoot weight, root weight, decrease in root galls and reduction in reproduction of nematodes. Soil amendments with different doses *viz.*, 2.5g, 5g and 10g/pot of botanicals significantly reduced the population of the root-knot nematode and thereby improved plant growth as compared to unammended control significantly. **Key words:** *Vigna radiata, Meloidogyne javanica,* Mungbean, Root-knot nematode, Organic management, soil ammendment

PATTERN OF ADOPTION OF VEGETABLE PRODUCTION TECHNOLOGIES BY KVK TRAINED VEGETABLE GROWERS

ADITYA KUMAR MALLA¹, JEEBANJYOTI BEHERA², AJIT KUMAR MALLICK³, SUBASHIS BHATTARAY⁴ ^{1,2}DEPARTMENT OF EXTENSION EDUCATION, COLLEGE OF AGRICULTURE, OUAT, BHUBANESWAR. ³DEPARTMENT OF EXTENSION EDUCATION, BCKV, WEST BENGAL.

⁴DEPARTMENT OF EXTENSION EDUCATION, BCKV, WEST BENGAL. ⁴DEPARTMENT OF AGRICULTURAL ECONOMICS, OUAT, BHUBANESWAR.

India is the second largest producer of vegetable next to China in the world accounting for about 12 per cent of world production.

Vegetables play a vital role in the maintenance of human health and make the diet nutritive and balanced. The study was conducted in Banapur, Tangi and Chilika blocks of Khordha district, Odisha. Both purposive and random sampling procedure was followed for selection of the district, blocks, gram panchayats, villages and the respondents. The total sample size of the study was 120. The response was obtained from each individual respondent in a structured interview schedule which was pretested with 10 per cent samples other than the respondents of the study. Regarding adoption, majority (72.5%) vegetable growers were under medium adoption level. They had more adoption in soil and land preparation with mean score 2.92. All of 13 socio-economic variables were positive and significant relationship with knowledge and adoption level obtained from correlation study. To augment vegetable production in the state, the new proven and viable technology on vegetable production which should be diffused through various extension activities to accelerate its adoption. **Key words:** KVK -Krishi Vigyan Kendra, TOT -Transfer of Technology, ICAR-Indian Council of Agricultural Research

ZERO BUDGET NATURAL FARMING: STATUS AND ITS OPPORTUNITY JEEBANJYOTI BEHERA¹, ADITYA KUMAR MALLA², POOJA JENA³ ¹DEPARTMENT OF EXTENSION EDUCATION, COLLEGE OF AGRICULTURE, OUAT, BHUBANESWAR ²DEPARTMENT OF EXTENSION EDUCATION, COLLEGE OF AGRICULTURE, OUAT, BHUBANESWAR ³DEPARTMENT OF EXTENSION EDUCATION, JNKVV (M.P)

In India, farming shifts from subsistence to commercial farming. The use of external and high cost inputs leads to high degree of credit risk, and traps farmer in a cycle of dept. In agriculture, farmers mainly depends on inorganic external chemical inputs such as fertilizers and pesticides. Due to heavy apply of chemicals, the soil productivity has been degraded and also it has increase the residue and toxicity level of various chemicals in soil. For this, an alternative and promising low-input farming practices have emerged by reducing input costs and increasing the yields for farmers, chemical-free food for consumers and improved soil fertility. Zero Budget Natural Farming (ZBNF) or holistic agriculture is a method of agriculture that counters the commercial expenditure and meets things required for the growth of plants, which will be present around the root zone (Palekar, 2007). The word 'budget' refers to credit and expenses and the phrase 'Zero Budget' means without using any credit, and without spending any money on purchasing of inputs. 'Natural farming' means farming with nature and without chemicals. Four pillars of ZBNF are 1. Jivamrita 2. Bijamrita 3. Acchadana- mulching and 4. Whapasa-moisture. It was originated in Karnataka where around one lakh families had adopted ZBNF. Andhrapradesh Govt. declared that ZBNF will be implemented in whole state and will cover 5 lakh farmers. Crop cutting experiments in Andhra Pradesh have shown increase in yield of cereals by 10 %, pulse by 27% and groundnut by 100% in the year 2016-17 (RySS, survey 2017). Comparing to other methods, this method is more sustainable, diverse, environment friendly and farmer friendly.

Key words: Natural farming, Sustainability, Zero Budget, Four pillars

BIOSTIMULANTS: SOURCE OF MITIGATION OF MOISTURE STRESS IN COW PEA PREETY RANI AND SARITA DEVI

DEPARTMENT OF BOTANY AND PLANT PHYSIOLOGY, CCS HARYANA AGRICULTURAL UNIVERSITY, HISAR

Biostimulants are the substances or living organisms applied to the plant or soil that increase the quality attributes of the plants, enhancing the crop quality, nutrient efficiency, stress tolerance translocation and yield. They have the potential to enhance germination, increase crop growth vigour and eventually improve cowpea leaf yields. Drought is prolonged shortage of water supply, it may be atmospheric or physiological. Drought is the major abiotic stress factor that causes extensive losses to agriculture production worldwide. It may cause oxidative stress and ionic stress in crop plants. The accumulation of proline appeared to be in response of drought injury rather than a drought tolerance mechanism. Cow pea is grown mostly under rain fed and semi arid regions. Cow pea growth can be promoted by stimulating nutrient uptake, chelating nutrients, providing plant growth hormones, or enhancing plant hormonal activity. Leaf extract of some plants or seaweed act as biostimulants in *Vigna*, it helps in stem thickness, increase the number of leaves and length. Biostimulants helps cow pea to thrive under drought condition. Drought causes increase in the concentration of osmo-protectants like proline, glycine betaine in the tolerant genotypes. Biostimulants beneficially influence cow pea to grow under various stress because these are the sources which can be used to mitigate all type of stress. Now a days biostimulants are used as approach to increase the productivity or increase the physiological traits of crop tends to optimize the agriculture system.

MOLECULAR AND AGRO-MORPHOLOICAL DIVERSITY AMONG BARLEY GENOTYPE OF BARLEY BREEDING PROGRAM

SWATI VERMA¹, SAJID REHMAN², SANJAYA GYAWALI^{2,4}, SHIKHA YASHVEER¹, YOGENDER KUMAR⁵, SHIAOMAN CHAO³, A. SARKER², AND RAMESH PAL SINGH VERMA²

¹DEPARTMENT OF MOLECULAR BIOLOGY, BIOTECHNOLOGY, AND BIOINFORMATICS, CCS HARYANA AGRICULTURAL UNIVERSITY, HISAR, INDIA

² BIODIVERSITY AND CROP IMPROVEMENT PROGRAM, INTERNATIONAL CENTER FOR AGRICULTURAL RESEARCH IN THE DRY AREAS (ICARDA), RABAT, MOROCCO

³USDA-ARS, FARGO, ND, USA

 ⁴ WASHINGTON STATE UNIVERSITY, MOUNT VERNON NORTH-WESTERN WASHINGTON RESEARCH & EXTENSION CENTER, 16650 STATE ROUTE 536, MOUNT VERNON, WA98273, USA
⁵ DEPARTMENT OF GENETICS AND PLANT BREEDING, CCS HARYANA AGRICULTURAL UNIVERSITY, HISAR,

INDIA

Barley (Hordeum vulgare L.), is one of the major cereal crops and has been cultivated since ancient time in different parts of the world. In particular, heat stress at post-heading stage causes considerable yield reduction due to the stress at critical stage, i.e., Anthesis and Grain Filling. Understanding the genetic variation, changes in physiological processes and level of genetic diversity existing among genotypes are needed to produce new cultivars not only having a high tolerance to heat stress, but also displaying high yield. So to address this challenge, a set of 316, diverse barley genotypes were procured from ICARDA center at Amlaha, MP, India. It was evaluated under two conditions timely sown (TS) and late sown (LS) conditions in two seasons of 2017-18 and 2018-19. The following morphological traits were recorded for the study: Plant height (Ph), days to heading (DH), days to maturity (DM), yield per plot (YPP), tillers per meter (T/mt), spike length (SL) and spikelets per spike (SPK) and also other physiological traits data was collected which included relative water stress, membrane stability etc. High genetic variation was observed among genotypes for all traits scored in this study. The results showed a clear reduction

in performance highest in tillers per meter (36.92%) in late sown as compared to timely sown codition followed by yield per plot (21.28%) A similar reduction in performance was observed for days to heading, days to maturity, Plant height was observed with a 20% reduction. Spike length and spikelets per spike reduced by 4.9% and 8.8%, respectively, due to the possible effect of heat stress in LS.The combination of analyses using molecular markers (SNPs), genetic variation in yield traits, and changes in physiological traits provided useful information in identifying the tolerant genotypes which can be used to improve heat tolerance in barley through breeding. **Keywords**: Hordeum vulgare · High temperature · Physiological traits · Genetic variation ·

ROLE OF AGROFORESTRY IN BIODIVERSITY CONSERVATION GYANARANJAN SAHOO* AND AFAQ MAJID WANI¹ COLLEGE OF FORESTRY, SHUATS, PRAYAGRAJ

Declining biodiversity is affecting food security, agricultural sustainability, and environmental quality. Agroforestry is recognized as a possible partial solution for Biodiversity conservation and improvement. Biodiversity, or the diversity of life in all its forms and at all levels of organization, has come under serious threat in many places in recent times. Some researchers have therefore called to develop strategies for eco-agriculture - a new type of agriculture that combines objectives of ensuring food security and conserving biodiversity in the same landscapes - to complement other conservation methods. Agroforestry can be classified as eco-agriculture, since integration of productive woody perennials in farming systems (which is the definition of agroforestry) is one of the eco-agriculture strategies of mimicking natural habitats to conserve some wild biodiversity Agroforestry also creates spatially concentrated high-density biodiversity near trees due to favourable soil-plant-water-microclimate conditions. The greater biodiversity was attributed to heterogeneous vegetation, organic carbon, microclimate, soil conditions, and spatial distribution of trees. Differences in biodiversity between agroforestry and other management types diminished with time. Diversity management can constitute a central part of livelihood management strategies of farmers and communities in different production system. This manuscript evaluates relationships between Agroforestry and Biodiversity and how agroforestry can be used to conserve biodiversity.

Key words : Agoforestry, Biodiversity, faunal diversity; floral diversity

FIELD EFFICACY OF CERTAIN GRANULAR INSECTICIDES AGAINST YELLOW STEM BORER Scirpophaga incertulas IN PADDY

ARVIND KUMAR, DEVENDRA PAL AND RAM KARAN SINGH KRISHI VIGYAN KENDRA SAMBHAL-244412

(SARDAR VALLABHBHAI PATEL UNIVERSITY OF AGRICULTURE & TECHNOLOGY, MEERUT-250110

Paddy (*Oryza sativa*) is a major edible cereal crop in India and world. Paddy crop is generally affected by a number of insect-pests but Yellow Stem Borer (YSB) is more destructive pest of paddy right from seedling to maturity causes yield losses 27-34% every year. To control the YSB in paddy farmers are applying a number of granular insecticides but most of them are more toxic and not suitable for IPM system. So now a days, promotion of comparatively less toxic and IPM suitable insecticides is must in paddy growing areas in modern agriculture. For solving this issue Krishi Vigyan Kendra ,Moradabad conducted an On Farm Trial during *kharif* 2014 on farmers field at five different locations, to evaluate the field efficacy of two granular insecticides i.e Cartap hydro-chloride 4G @ 20kg/ha and Fipronil 0.3 G @ 25kg/ha. Both of these insecticides are less toxic and IPM suitable, compared with control (Carbofuran 3CG @ 20kg/ha) which is used by a large number of paddy growers in the district. The result showed that YSB infestation was found 6.25% in Cartap hydrochloride applying fields. It was followed by Fipronil 0.3 G applying fields i.e 8.33% as compare to control (Carbofuran 3 CG) i.e 12.5%. Similarly the highest grain yield (45.0 q/ha) with higher BC ratio (3.03) was obtained by applying Cartap hydrochloride 4G which was 12.5 % more than control (Carbofuran 3 CG). It was followed by applying Fipronil 0.3G (44.0 q/ha) with BC ratio (2.93) which was 10% more than control. However control gave lowest grain yield (40.0 q/ha) with BC ratio (2.71). It was concluded that Cartap hydrochloride 4G is good for higher grain yield, less infestation of YSB and it is also suitable for IPM system.

EVALUATION OF NUTRITIONAL QUALITY OF IMPROVED VARIETIES OF BLACK GRAM (*PHASEOLUS MUNGO*) ANJALI KANTH, KANCHAN GOSWAMI* AND PUSHPA SHUKLA

DEPARTMENT OF FOODS AND NUTRITION, COLLEGE OF HOME SCIENCE, G.B. PANT UNIVERSITY OF AGRICULTURE AND TECHNOLOGY, PANTNAGAR

Black gram (*Phaseolus mungo*) is a legume belonging to family Fabaceae and Genus *Phaseolus*. It is a nutritious legume and also a good source of protein. It is generally recognized as urad bean, mash bean, black lentil, or white lentil. It is one of the less studied legumes but is generally used in India, East Africa, Pakistan, Greece and Iran. In the Indian subcontinent black gram is a highly prized legume.Evaluation of nutritional quality of improved varieties of Black gram (*Phaseolus mungo*). The improved varieties of Black gram i.e., Pant U-8, Pant U-9, Pant U-31 and Pant U-35 were procured from CRC (Crop Research Centre), Pantnagar for the study and nutritional evaluation was done using the standard procedures. On the basis of nutritional content of four varieties, Pant U-31 had highest protein, mineral and dietary fiber content. Pant U-8 had highest Moisture content, carbohydrate content and energy value. Statistical analysis of data for fat content showed that there is non-significant difference between all the varieties of black gram. And for Anti-nutrient content results showed non-significant difference between all the varieties of black gram. Due to its nutritional qualities whole black gram can be used in different food products to maximize its utilization.

Keywords: Black Gram, Nutritional content, Legume, Varieties,

EXPLORING THE ARID UNDERUTILIZED FRUITS FOR FOOD AND NUTRITIONAL SECURITY KALPANA CHOUDHARY*, NIRMAL KUMAR MEENA, SONALI CHOUDHARY** AND VAISHALI GUPTA COLLEGE OF HORTICULTURE AND FORESTRY, AU, KOTA, JHALARAPATAN, JHALAWAR- 326 023 (RAJASTHAN) **YS PARMAR UHF, NONI, SOLAN (HP)

Western desert part of India enriched with various underutilized fruits which are rarely cultivated by the farmers. Though, fruits are not cultivated but traditionally used by the local people. These fruit speciesbestowed with high nutritive and medicinal values. Many indigenous fruit crop species that have been neglected having great potential to augment food and nutraceautical securityfor rural and tribal

peoples. Among them, *Ker (Capparis decidua), Pilu(Salvadora oleoides), Khejri (Prosopis cineraria), Phalsa (Grewia subinequalualis), Lasora* or *Goonda (Cordia myxa)*, Jharberi (*Zizyphus nummularia), etc.* are predominant. Owing to their antioxidant activity these fruits, act as a functional foods, which provide healthy substances in addition to calories and minerals. Mature fruits of *Pilu* and *Ker* are rich source of many phytochemicals like carotenoids, phenolic. Ber is richer than apple in their nutritive values such as protein, carotene and vitamin C. Consumption of antioxidant rich food suppresses development of many diseases. The interest in phytochemical content of minor fruit species is increasing in human health. Apart from this, these fruits are used to prepare various processed products like jam, jelly, pickles and many beverages which ensure the round year taste of particular fruit. These processed products are sold by local vendors which generate additional return and secure livelihood.

Keywords: Arid fruits; antioxidants; nutraceuticals; health benefits

GENOME WIDE ASSOCIATION STUDIES TARGETING RESISTANCE AGAINST MULTIPLE RUSTS IN INDIAN BREAD WHEAT

DEEPENDER KUMAR^{1, 2}, VINOD CHHOKAR¹, O.P. GANGWAR³, M SIVASAMY⁴, S. V. SAI PRASAD⁵, AND RATAN TIWARI²

¹DEPARTMENT OF BIO AND NANOTECHNOLOGY, GURU JAMBHESHWAR UNIVERSITY OF SCIENCE AND TECHNOLOGY, HISAR

²ICAR-INDIAN INSTITUTE OF WHEAT AND BARLEY RESEARCH, KARNAL

³ICAR-INDIAN INSTITUTE OF WHEAT AND BARLEY RESEARCH, REGIONAL STATION, FLOWERDALE, SHIMLA ⁴ICAR-INDIAN AGRICULTURAL RESEARCH INSTITUTE, REGIONAL STATION, WELLINGTON

⁵ICAR-INDIAN AGRICULTURAL RESEARCH INSTITUTE, REGIONAL STATION, INDORE

Out of several important wheat foliar diseases, Stripe rust (Yr), Leaf rust (Lr), and Stem rust (Sr) have always been a concerned issue for farmers and wheat breeders. Evolving virulence in multiple rusts has always posed a major threat to an epidemic. Eventually, fungicides will become less effective against it. To achieve durable long term resistance against multiple rusts, it is important to search for novel sources of resistant alleles. Pyramiding several known resistant genes can only post-pone the inevitable threat. A diverse association mapping panel of more than 400 genotypes was evaluated for multiple rusts for two consecutive crop seasons (2017-19) at two locations. The evaluation of the panel for adult plant resistance (APR) was conducted in an augmented block design with a susceptible check line at regular intervals. Experiments for seedling stage resistance (SRT) was conducted using virulent pathotypes of multiple rusts in controlled greenhouse conditions. The genotyping of the panel was performed using 35K Axiom SNP array and the association studies were explored to determine significant marker-trait association (MTA). More than 14K SNP markers were found polymorphic and highly informative. Genome-wide association studies were performed using a compressed mixed linear model approach with kinship and population structure as random and fixed components, respectively. In our preliminary study, more than 800 MTAs were observed to be associated with 12 environments for APR and 18 pathotypes for SRT at a significant level of $-log_{10}p \ge 3$. To identify the most relatable MTA in the study, genes associated with these MTAs were studied to identify putative candidate genes of interest. Several genotypes were observed to have strong APR. The identified diverse resistant sources for multiple rusts will be proposed to the breeders as crossing block entries for varietal improvement.

Keywords: SNP, genome-wide association studies, rust, wheat.

PRESENT STATUS AND PROSPECTS OF ORGANIC PRODUCTION & TREND IN INDIA DEVYANEE K.NEMADE¹, SULBHA SARAP², SANGITA WARADE³ & SWATI GAWANDE⁴ DEPARTMENT OF AGRICULTURAL ECONOMICS & STATISTICS, DR. PDKV, AKOLA SHRI. SHIVAJI COLLEGE OF AGRICULTURAL, AMRAVATI DEPARTMENT OF AGRICULTURAL ECONOMICS & STATISTICS, DR. PDKV, AKOLA

DEPARTMENT OF EXTENSION EDUCATION, DR. PDKV, AKOLA

Before invention of chemical fertilizers, pesticides and other chemical additives, the farming based on organic system was very common in each and every part of the world. India is one of the country traditionally practicing organic crop productions since ancient times. Consequently, industrialization and commercialization of agriculture chemical based inputs were introduced for nutrient and pest management and enhancing productivity per unit area. In recent years, however limitations of agriculture based on chemical use and intensive irrigation have become apparent and there has been a resurgence of interest in organic agriculture. Currently, India ranks 9th in terms of World's Organic Agricultural land and 1st in terms of total number of producers(FIBL and IFOAM year book), 2018). This research focuses on the present status and prospects of organic farming in India. Keeping in view of this study has been undertaken with following objectives. To study the area, production of organic farming in India. To examine the trends in production and exports of organic products in India. The data was collected from the secondary sources i. international federation of organic farming movements (IFOAM), International Trade Centre (ITC), National programme of organic production (NPOP), APEDA (Agricultural processed food products & export development, Reports, Journals, Periodicals and newspapers etc. for the period 2002-03 to 2018-19. The present study analyses variability of Area, production and Export of organic products through coefficient of variations. Compound growth rate (CGR) was estimated using the exponential regression model to examine the trends in production and exports of organic products in India. The result was concluded that, the total area of both organic & wild collection in India has increased from 2.57 million hectares in 2005 to 3.43 million hectares in 2018-19. Among all the states, In percentage Madhya Pradesh (34.67 per cent) has covered largest area under organic certification followed by Maharashtra (14.43 per cent)) and Rajasthan(10.06 per cent) respectively. The per cent change of India of organic product volume and value of export was 51.12 per cent to 47.96 per cent and 17.25 per cent to 39.38 per cent respectively during 2002-03 to 2018-19. India is exporting organic products to all the continents of the world of which the largest share goes to European Union(38.85 %) followed by USA(37.87 %). An attempt made to analyze the importance of Organic farming and exports of organically produced product in India. Organic product are exported to European Union, Canada, USA, Switzerland, Australia, New Zealand etc. Key words: Organic Farming, Production & Exports

EFFECT OF ENVIRONMENT ON ADVANCE PIGEONPEA LINES

DEEPAK PAL* AND S. K. VERMA DEPARTMENT OF GENETICS & PLANT BREEDING, GOVIND BALLABH PANT UNIVERSITY OF AGRICULTURE & TECHNOLOGY PANTNAGAR

The present investigation was conducted at three different locations, two at the Norman E. Borlaug Crop Research Centre, Pantnagar (Pigeonpea Breeding Block Date of sowing July 2, 2016) and Pigeonpea Entomology Block (Date of sowing June 16, 2016) of G. B. Pant University of Agriculture and Technology, Pantnagar during kharif 2016 while third at Agricultural Research Station, Majhera (Almora), G. B. Pant University of Agriculture and Technology, Pantnagar. The experimental material comprised of seventeen advance lines of pigeonpea and three checks viz., PUSA 992, PARAS and UPAS 120. These genotype were evaluated in a randomized block design with three replications and observations were recorded on ten character viz., days to 50 percent flowering, days to maturity, plant height, number of primary branches per plant, number of secondary branches per plant, number of pod per plant, number of seed per pod, main shoot length, seed index and seed yield per plot. At each location data was recorded on five randomly selected plants from each replication and analyzed for stability along with genetic variability, heritability, genetic advance, correlation and path coefficient using appropriate statistical method. Analysis of variance revealed significant differences among genotypes for all the characters except seed yield per plot in all the three environments. In general, phenotypic coefficient of variation estimates were higher than the corresponding genotypic coefficient of variation estimates for all the ten characters in all the three environments. In general, high estimates of broad sense heritability were observed for days to 50 percent flowering, days to maturity and seed index in all the three environments. In the present study, in general, high heritability coupled with high genetic advance as percent of mean was observed for seed index whereas high heritability estimates coupled with low or moderate genetic advance as percent of mean were observed for days to 50 percent flowering and days to maturity in all the three environments. Over the environments, seed yield per plot was positively and significantly correlated with days to 50 percent flowering, days to maturity and number of pods/plant. Number of pod per plant and number of seed per pod exhibited positive and highest direct effect on seed yield per plot in all the three environments. Pooled analysis of variance revealed that differences among genotypes were significant for all the characters except number of primary branches per plant. Among the genotypes, PA 538, PA 549 and PA 540 were found to be the most desirable and stable for seed yield per plot. Apart from this character, PA 538 for number of secondary branches per plant, PA 549 for seed index and days to 50% flowering and PA 540 for main shoot length exhibited stability over different environments. Among the checks, PUSA 992 for main shoot length, PA 550 was found to be stable for number of seed per pod and plant height, and UPAS 120 for main shoot length showed stability and wider adaptability over different environments. These findings will be useful in future breeding programme.

SECONDARY METABOLITES MEDIATED DEFENCE RESPONSES AGAINST *COLLETOTRICHUM CAPCISI* AND COLLETOTRICHUMINE A IN CHILLI (*CAPSICUM ANNUM* L.)

MANOJ KUMAR CHITARA^{1*}, CHETAN KESWANI², HARIKESH BAHADUR SINGH³, JONATHAN SPERRY⁴ ¹DEPARTMENT OF PLANT PATHOLOGY, COLLEGE OF AGRICULTURE, GOVIND BALLABH PANT UNIVERSITY OF AGRICULTURE AND TECHNOLOGY, PANTNAGEAR

²DEPARTMENT OF BIOCHEMISTRY, INSTITUTE OF SCIENCE, BANARAS HINDU UNIVERSITY, VARANASI ³DEPARTMENT OF MYCOLOGY AND PLANT PTHOLOGY, INSTITUTE OF AGRICULTURAL SCIENCES, BANARAS HINDU UNIVERSITY, VARANASI

⁴SCHOOL OF CHEMICAL SCIENCES, UNIVERSITY OF AUCKLAND, NEWZEALAND

Secondary metabolites are the substances which is produced in the plants after attack of the pathogen or foreign particles, which found a role in defence in plants. Herein research was conducted on 21 old days chilli seedling inoculated with *Colletotrichum capsici*, Colletotrichumine A and both combined at different concentration. Total phenols increased in the inoculated chilli seedlings compared to the corresponding healthy seedlings. Total phenols were maximum at 3-4 day after inoculation. In comparison with *Colletotrichum capsici* and Colletotrichumine A treated alone, chilli seedlings inoculated with consortia of *Colletotrichum capsici* and Colletotrichumine A treated alone, chilli seedlings and higher activities of enzymes. High-performance liquid chromatography (HPLC) analysis showed that the defence enzymes like catechin, kaempferol, ferulic acid, gentistic acid, and shikimic acid also produce higher in comparison with *Colletotrichum capsici* and Colletotrichum capsici and Colletotrichum caps

Keyword- Chilli, Colletotrichum capsici, Colletotrichumine A, Total phenol and High-performance liquid chromatography.

EVALUATION OF SYSTEMIC AND NON- SYSTEMIC FUNGICIDES AGAINST *RHIZOCTONIA SOLANI* KÜHN CAUSING WEB BLIGHT DISEASE IN MUNGBEAN

SADHNA CHAUHAN*, L.B. YADAV

DEPARTMENT OF PLANT PATHOLOGY, G B PANT UNIVERSITY OF AGRICULTURE AND TECHNOLOGY, PANTNAGAR 263145, UTTARAKHAND

Web blight disease *caused by Rhizoctonia solani* Kühn [*Thanatephorus cucumeris* (Frank) Donk] is a major serious constraint in mungbean production which is one of the important pulse crops of the country resulting in heavy yield losses. An effort was made to determine the efficacy of some fungicides against *Rhizoctonia solani* using poison food technique. Six systemic fungicides *viz*. Carbendazim, Propiconazole, Hexaconazole, Difenoconazole, Azoxystrobin and Thiophanate Methyl and two contact fungicides *viz*. Mancozeb and Zineb were screened *in vitro* against *R. solani* for their antifungal activity at the concentration of 5.0, 10.0, 15.0, 20.0 ppm and 25.0, 50.0, 100.0 and 400.0 ppm respectively. All the fungicides differ significantly from check and also from one another in reducing radial growth of the fungus except Carbendazim and Propiconazole (93.33 %), Carbendazim (92.59 %) and Azoxystrobin (91.48 %) were found highly effective against the radial growth of *R. solani* at all concentrations whereas Thiophanate Methyl (80.93 %) was found least effective followed by Difenoconazole (86.85%) as compared to other systemic fungicides. Among, contact fungicides Mancozeb (87.00%)

was found most effective in reducing the radial growth of *R. solani* at 400 ppm concentration whereas Zineb (76.00%) was found less effective as compared to Mancozeb.

Keywords: web blight, Rhizoctonia solani, mungbean, Propiconazole, Azoxystrobin

ROLE AND OPPORTUNITIES OF BIODEGRADABLE PLASTIC MULCHES IN HORTICULTURAL CROPS PRODUCTION JITENDRA SINGH SHIVRAN*¹ AND MOHAN LAL JAT²

¹DEPARTMENT OF HORTICULTURE, GB PANT UNIVERSITY OF AGRICULTURE & TECHNOLOGY, PANTNAGAR, UTTARAKHAND- 263145 (INDIA)

²DEPARTMENT OF HORTICULTURE, CCS HISAR AGRICULTURAL UNIVERSITY, HISAR, HARYANA-125004 (INDIA) The use of plastic mulch in agriculture has increased dramatically in the last 10 years throughout the world. This increase is due to benefits such as increase in soil temperature, reduced weed pressure, moisture conservation, reduction of certain insect pests, higher crop yields, and more efficient use of soil nutrients. However, disposing of used plastic films, which cause pollution, has led to development of photodegradable and biodegradable mulches (Subrahmaniyan and Mathieu, 2012). Biodegradable plastics are made with polymers (i.e. macromolecules), which are recognised by enzymes present in nature (Razza and Innocenti, 2012). The biodegradable mulch films had similarly good results when comparing to the PE, with no significant differences in productivity or quality. Overall, the new biodegradable mulch films appear to be a viable substitute to the PE. The use of plastic materials for mulching is a very common practice for vegetable crops. Black polyethylene is the most widely used due to its excellent properties and low cost. However, the massive use of these materials supposes an environmental risk. In the last few years, the use of starch-based biodegradable films has been introduced as an alternative to conventional mulches (Costa et al., 2014). BDMs do not have to be removed, but rather they are tilled into the soil or composted at the end of the season.Biodegradable plastic mulches are important materials employed in the sustainable production of vegetables and other specialty crops.Biodegradable plastic mulch significant increases in yield, earliness, product quality, weed control efficacy, microclimatic improvement and film soil coverage in a variety of vegetables can be grown successfully *i.e.* mulches, muskmelons, honeydews, watermelons, squash, cucumbers, tomatoes, peppers, eggplant, okra, sweet corn, , strawberry, lettuce and cole crops. Keywords: Biodegradable plastic mulchs (BDMs), polyethylene (PE), sustainable production, plastics, etc.

ROLE OF BIO-FERTILIZERS IN VEGETABLES CROPS RAJESH CHOUDHARY^{*1}, PRAVEEN CHOYAL¹ AND ASHOK CHOUDHARY² ¹DEPARTMENT OF HORTICULTURE, SKN COLLAGE OF AGRICULTURE, JOBNER, JAIPUR. ²DEPARTMENT OF HORTICULTURE, GBPUAT, PANTNAGAR, UTTARAKHAND.

Bio-fertilizers are considered as an alternative to chemical fertilizers in modern vegetable production and bio-fertilizers contain microorganisms which promote the adequate supply of nutrients to the host plants and ensure their proper development of growth and regulation in their physiology. Chemical fertilizers supply over nitrogen whereas bio-fertilizers provide in addition to nitrogen certain growth promoting substances like hormones, vitamins, amino acids, etc. Obviously, the chemical fertilizers are expensive, not environment friendly and they are also responsible for water, air and soil pollution. Bio-fertilizers application in agriculture will have greater impact on organic agriculture and also on the control of environmental pollution, soil health improvement and reduction in input use. Farmers try to increase yields of vegetable crops by mean of heavy nutrition's. The use of chemical nitrogen and phosphorus fertilizers at high levels had an adverse effect on the accumulation of NH4+, NO3-, NO2- and PO4- in vegetable product tissues. Therefore, clean agriculture recently depends upon using bio-fertilizers as well as organic in order to produce high yields with the best commodity quality without contamination and less accumulation with heavy metals.

Key words: Bio-fertilizers, soil health, Vegetable production and Yield.

USE OF PLANT PRODUCTS, BIO CONTROL AGENTS, CHEMICALS AND ORGANIC AMENDMENTS FOR INTEGRATED MANAGENENT OF *RHIZOCTONIA SOLANI* IN COWPEA

ABHISEK TRIPATHY¹, ASHRUTI KESHARWANI², SUDAM CHARAN NAHAK³ AND ANIRUDHA TARAI⁴

^{1,3}DEPARTMENT OF PLANT PATHOLOGY, ODISHA UNIVERSITY OF AGRICULTURE AND TECHNOLOGY, BHUBANESWAR

²DEPARTMENT OF PLANT PATHOLOGY, INDIRA GANDHI KRISHI VISHWAVIDYALAYA, RAIPUR

⁴DEPARTMENT OF AGRONOMY, ODISHA UNIVERSITY OF AGRICULTURE AND TECHNOLOGY, BHUBANESWAR

For integrated disease management of root and stem rot of cowpea caused by *Rhizoctonia solani* experiments were conducted using different plant products, bio control agents, chemicals and organic amendments during *Kharif* of 2017-18. Out of seven phytoextracts tested against *Rhizoctonia solani*, the maximum inhibition was recorded in garlic(100%) followed by turmeric(34.08%) at 10 % concentration, whereas maximum inhibition 100% was recorded in both 15% and 20% concentration in garlic and calotropis respectively. Out of four biological agents were tested against *Rhizoctonia solani*, *Bacillus subtilis* was recorded maximum growth inhibition of 72.04% as compared to *Trichoderma hamatum* (49.78%) and *Trichoderma harzianum* (46.00%). *In vitro* studies of 13 fungicides against *Rhizoctonia solani* revealed that Carboxin 37.5% + Thiram 37.5%, Hexaconazole 5%, Difenoconazole 25%, Tebuconazole 25% and Tebuconazole 50% + Trifloxystrobin 25% recorded maximum growth inhibition (100%). *In vivo* studies of 13 fungicides maximum mortality was recorded from Carbendazim 50% followed by Propineb 70% (82% and 65.97%) respectively. Among the organic products tested against Rhizoctonia *solani*, the minimum mortality was recorded from spent mushroom substrate + Cow dung + Vermicompost followed by Vermicompost with 10% and 15% mortality respectively. The maximum mortality was recorded from Poultry manure (66.67%) as compared to rest of the treatments and control.

Key words: Phytoextract, Rhizoctonia solani, Biological agents, Bacillus subtilis, Cow pea

ECO-FRIENDLY MANAGEMENT OF FRUIT ROT OF CHILLI CAUSED BY COLLETOTRICHUM CAPSICI WITH CERTAIN LIQUID FUNGAL BIOFORMULATIONS

SUNITA DUTTA¹, DAISY SENAPOTY¹ AND PRANAB DUTTA¹

¹DEPARTMENT OF PLANT PATHOLOGY, ASSAM AGRICULTURAL UNIVERSITY, JORHAT-785013,ASSAM,INDIA

India is a leading vegetable producing country in the world and ranks second next to China. Chilli (*Capsicum annum*) is an economically important vegetable crop grown in the subtropical and tropical regions of the world. Fruit rot is one of the most destructive fungal disease of chilli causing considerable losses to the fruit in field, storage, transit and marketing. The commercial cultivation of the crop is under serious threat in Assam due to this disease. Present study was carried out to study the *in-vitro* efficacy of three liquid fungal bio-formulations *viz.*, *Org-Trichojal*, *Org- Metajal* and *Org-Beauverijal* alone and in combinations with each other against the chilli fruit rot pathogen *Collectotrichum capsici* by "Poisoned food technique". Comparison was made with chemical check (<u>Captan@0.2%</u>). Result showed that combination of the three fungal bio-formulations were best in radial growth inhibition of the test pathogen as compared to their individual efficacy. This was followed by combination of both *Org- Trichojal* and *Org- Metajal*. Thus we can conclude that combined application of these fungal bio-formulations have potentiality of suppressing the pathogen causing fruit rot of chilli. **Key words:** Fruit rot, Chilli, Organic management

INSIGHT INTO THE WHEAT RHIZOSPHERIC BACTERIAL COMMUNITY WITH BIOLOGICAL CONTROL POTENTIAL AGAINST FOLIAR BLIGHT DISEASE OF WHEAT (*TRITICUM AESTIVUM*) <u>VANDANA JAGGI¹</u> AND MANVIKA SAHGAL¹

GOVIND BALLABH PANT UNIVERSITY OF AGRICULTURE AND TECHNOLOGY, PANTNAGAR, UTTARAKHAND¹

Wheat is the second most important cultivated food crop in India (after rice). Successful production of wheat is constrained by several biotic and abiotic stresses. The most devastating biotic stress on wheat production is foliar blight. It occurs as a complex of spot blotch, caused by Bipolaris sorokiniana and leaf blight caused by Alternaria triticina. Globally, an estimated 25 million ha of wheat land is affected by spot blotch, of which 9 million ha in India alone. There are several studies on chemical control of foliar blight but little is known about its biological control. In the present study a total of 45 rhizobacteria with *invitro* antagonistic potential against foliar blight pathogens were isolated from wheat fields in Uttarakhand (Almora and Pantnagar), Uttar Pradesh, Madhya Pradesh and Maharashtra. Invitro antagonistic potential of bacteria was determined by measuring % mycelia growth inhibition (%MGI) with whole cell, cell free supernatant and ethyl acetate bacterial extract separately in dual culture plate assay. Hydrolytic enzyme production (Amylase, pectinase, lipase and protease) and PGP traits (Ammonia, siderophore production and Zinc, Phosphate solubilization) of bacteria were also assessed. Bacterial isolates showed different degrees of antagonism in whole cell, cell free supernatant and ethyl acetate bacterial extract. Maximum antagonistic activity against B. sorokiniana was calculated as 58.14, 63.21 and 72.54 % in whole cell, cell free supernatant and ethyl acetate bacterial extract respectively. Whereas, 58, 60.15 and 69.97% against A. triticina. Out of 45 rhizobacteria, 64.44% produced amylase, 57.77% pectinase, 17.77% lipase and 35.55% protease. Further 51.11 % were found positive for ammonia production, 62.22% for siderophore production, 60 % for zinc solubilization and 26.66 % for inorganic P solubilization. Amongst 45 isolates, bacterial isolate P10 scored maximum 21 points on a bonitur scale of 26 points considering in vitro antagonistic potential, hydrolytic enzyme production and PGP traits and consequently, suggested as potent biocontrol agent against foliar blight of wheat.

Key word: Leaf blight, PGP traits, Antagonism, Biotic stress

QUANTITATIVE STUDY OF ENZYME ACTIVITIES AND PROTEIN CONTENT IN WHEAT UNDER VARIOUS LEVELS OF ZINC AND IRON

$BHUPENDRA\ MATHPAL^1, PRAKASH\ CHANDRA\ SRIVASTAVA^3\ SHAILESH\ CHANDRA\ SHANKHDHAR^2$

1 SCHOOL OF AGRICULTURE, LOVELY PROFESSIONAL UNIVERSITY, PHAGWARA, PUNJAB 144411, INDIA 2 DEPARTMENT OF PLANT PHYSIOLOGY, COLLEGE OF BASIC SCIENCES AND HUMANITIES, G. B. PANT

2 DEPARTMENT OF PLANT PHYSIOLOGY, COLLEGE OF BASIC SCIENCES AND HUMANITIES, G. B. PANT UNIVERSITY OF AGRICULTURE AND TECHNOLOGY, PANTNAGAR 263145, INDIA

3 DEPARTMENT OF SOIL SCIENCE, COLLEGE OF AGRICULTURE, GBPAT, PANTNAGAR

A pot experiment was conducted to evaluate the effect of zinc (Zn) and iron (Fe) levels on key enzyme activities and protein content in grains of two contrasting wheat genotypes *viz.*, UP2628 (Zn efficient) and UP262 (Zn inefficient). Tested levels of Zn (0, 0.25 and 0.5% ZnSO₄) and Fe (0, 0.5 and 1.0% ZnSO₄) were applied at 30, 60 and 90 days after sowing (DAS) of crop. Maximum (0.135 Units min⁻¹) superoxide dismutase (SOD) activity was recorded at 0.5% Zn+0% Fe in UP2628 whereas at the same combination of Zn and Fe, carbonic anhydrase (CA) activity was also found to be maximum (22.95 Units mg⁻¹ fr. wt.) in UP2628. Regarding catalase (CAT) activity maximum (26.87 Units mg⁻¹ fr. wt.) was recorded at 0% Zn+1.0% Fe in UP262 while 0.5% Zn+0% Fe was found most effective in improving peroxidase (POD) activity and maximum (0.211 Units mg⁻¹ fr. wt.) was expressed by variety UP2628. Increasing levels of Zn and Fe were enhanced protein content in grains of both the varieties and maximum (9.82%) was found in UP2628 at 0.5% Zn+1.0% Fe. On comparison of both the varieties, UP2628 was found to be expressed all the enzymes and protein content in more concentration in comparison to UP262.

Keywords: SOD, CA, CAT, POD and protein content in wheat grain.

ZERO BUDGET NATURAL FARMING SYSTEM

HIMANSHU TIWARI*, DR. A.K. SINGH**

*DEPARTMENT OF AGRONOMY, ACHARYA NARENDRA DEV UNIVERSITY OF AGRICULTURE AND TECHNOLOGY KUMARGANJ AYODHYA UP

** DEPARTMENT OF AGRIL. METEOROLOGY, ACHARYA NARENDRA DEV UNIVERSITY OF AGRICULTURE AND TECHNOLOGY KUMARGANJ AYODHYA UP

We know that India is an agricultural country and approx. 60% people depend means credit and expenses, thus "Zero Budget" means without using any credit or money and "Natural farming System" means with nature or without using chemical. Zero budget natural farming system is a method of farming where the cost of growing and harvesting crop plants is zero. It is basically a natural farming system that uses biological pesticides instead of chemical based fertilizers. Farmers use earthworms, cow dung, urine, plants and such biological fertilizers for crop production. In Zero Budget, farmers use mulching, soil protection techniques, natural pesticides and fertilizers. The
principal of ZBNFS includes crop rotation, green manures and compost, biological pest control, and mechanical cultivation. In ZBNFS about 98% nutrients are taken from air, water and solar energy. Remaining 1.5% nutrients taken from the soil are also available free of cost as it is taken from the prosperous soil which is enriched with these nutrients. ZBNFS is an approach towards sustainability, expense-free farming and the farming up to 30 acres with one native cow .The most popular pillars of ZBNFS i.e. Jivamitra, Bijamitra, Acchadana, Whapasa. The ZBNFS can be best suited for marginal farmers as well as the conservation of agricultural land too. **Keywords**: Zero Budget , Natural Farming , Sustainability

GROWTH RATE ANALYSIS OF INDIAN VALUE ADDED COFFEE

VARUN GANGADHAR^{1*}, PRAMIT PANDIT², BISHVAJIT BAKSHI¹, POOJA B. S.¹

¹DEPARTMENT OF AGRICULTURAL STATISTICS, APPLIED MATHEMATICS AND COMPUTER SCIENCE, UNIVERSITY OF AGRICULTURAL SCIENCES, BENGALURU, KARNATAKA, INDIA, 560065 ²DEPARTMENT OF AGRICULTURAL STATISTICS, BIDHAN CHANDRA KRISHI VISWAVIDYALAYA, MOHANPUR,

NADIA, WEST BENGAL, INDIA, 741252

Coffee is considered as one of the vital non-alcoholic beverages in the world. Data of ten years' period from 2007-08 to 2016-17 were collected from Coffee Board of India, Bengaluru for the purpose of analyzing the growth rate of value added coffee export. The linear and compound growth rate was found to be significant for instant and pooled value added coffee. Whereas for ground and roasted coffee, the linear and compound growth rate were found to be non-significant which may be due to less preference in international export markets compared to instant coffee. For instant coffee, growth rate was found to be highest and positively significant for Turkey, Indonesia and Poland because of increased demand from these countries. The growth rate was found to be non-significant because export to these had reached the plateau. The compound and linear growth rate of ground coffee was found to be highest for Australia because of more preference is given to Indian ground coffee from last four years. USA, Italy, Ukraine, Finland, Kuwait and other countries were found non-significant growth rate. For roasted coffee, all the countries except Singapore was found to be non-significant. In case of pooled value added coffee, the growth rate was found to be highest for Turkey and negative growth rate was found for Finland. For Russian federation and Ukraine, the growth rate was found to be non-significant. Key words: Coffee, Growth rate, Indian coffee, Value added coffee.

ROLE OF AGROFORESTRY IN BIODIVERSITY CONSERVATION GYANARANJAN SAHOO* AND AFAQ MAJID WANI $^{\rm 1}$

DEPARTMENT OF FOREST BIOLOGY AND TREE IMPROVEMENT, COLLEGE OF FORESTRY, SHUATS, PRAYAGRAJ

Declining biodiversity is affecting food security, agricultural sustainability, and environmental quality. Agroforestry is recognized as a possible partial solution for Biodiversity conservation and improvement. Biodiversity, or the diversity of life in all its forms and at all levels of organization, has come under serious threat in many places in recent times. Some researchers have therefore called to develop strategies for eco-agriculture - a new type of agriculture that combines objectives of ensuring food security and conserving biodiversity in the same landscapes - to complement other conservation methods. Agroforestry can be classified as eco-agriculture, since integration of productive woody perennials in farming systems (which is the definition of agroforestry) is one of the eco-agriculture strategies of mimicking natural habitats to conserve some wild biodiversity Agroforestry also creates spatially concentrated high-density biodiversity near trees due to favourable soil-plant-water-microclimate conditions. The greater biodiversity was attributed to heterogeneous vegetation, organic carbon, microclimate, soil conditions, and spatial distribution of trees. Differences in biodiversity between agroforestry and other management types diminished with time. Diversity management can constitute a central part of livelihood management strategies of farmers and communities in different production system. This manuscript evaluates relationships between Agroforestry and Biodiversity and how agroforestry can be used to conserve biodiversity.

Key words : Agoforestry, Biodiversity, faunal diversity; floral diversity

STUDY ON ATTITUDE OF POST GRADUATE STUDENTS TOWARDS AGRICULTURAL RESEARCH

ADE ANIL 1, HINGONEKAR SAJAN 2 AND NIGADE DHANSHRI 3

DEPTT. OF EXTENSION EDUCATION, COLLEGE OF AGRICULTURE, PARBHANI, M. S.,

Present study was carried out in Navsari Agricultural University, Navsari district of South Gujarat on year of 2011. The main objective of this study was to find out attitude of post graduate students towards agricultural research. The study conducted on registered post graduate students selected from N. M. College of Agriculture and ASPEE College of Horticulture and Forestry, Navsari. The post graduate students of different disciplines were considered as respondents. Total 100 post graduate students were in all the size of sample for the present study. The "ex-post facto" research design was used for this study. A structural interview schedule was designed for collecting the data. This study concluded that, majority (64.00 per cent) of the post graduate students had moderately favourable attitude towards agricultural research, while 26.00 per cent and 10.00 per cent of the students had highly favourable and less favourable attitude towards agricultural research, respectively.

Key words: Attitude, Post graduate students, research, etc.

STUDY ON ATTITUDE OF POST GRADUATE STUDENTS TOWARDS AGRICULTURAL TEACHING ADE ANIL 1, SAWANT VIJAY 2 AND NIGADE DHANSHRI 3

DEPTT. OF EXTENSION EDUCATION, COLLEGE OF AGRICULTURE, PARBHANI, M. S.,

Present study was carried out in Navsari Agricultural University, Navsari district of South Gujarat on year of 2011. The main objective of this study was to find out attitude of post graduate students towards agricultural teaching. The study conducted on registered post graduate students selected from N. M. College of Agriculture and ASPEE College of Horticulture and Forestry, Navsari. The post graduate students of different disciplines were considered as respondents. Total 100 post graduate students were in all the size of sample for the present study. The "ex-post facto" research design was used for this study. A structural interview schedule was designed for collecting the data. This study concluded that, the more than half (57.00 per cent) of the post graduate students had moderately favourable attitude towards

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agricultural teaching, while 33.00 per cent and 10.00 per cent of the students were having highly favourable and less favourable attitude towards agricultural teaching, respectively.

Key words: Attitude, Post graduate students, Teaching, etc.

DEVELOPMENT OF TESTING DESIGN (SCALE) TO MEASURE ATTITUDE OF POST GRADUATE STUDENTS TOWARDS AGRICULTURAL EXTENSION

ADE ANIL 1, SAWANDKAR DIPALI 2 AND NIGADE DHANSHRI 3

DEPTT. OF EXTENSION EDUCATION, COLLEGE OF AGRICULTURE, PARBHANI, M. S.,

Due to non-availability of a proper scale to measure attitude of post graduate students towards Agricultural Extension in Gujarat State, it was thought necessary to construct a scale for the purpose. Keeping this in view, an attempt has been made to develop a scale for measuring the attitude of postgraduate students. The scale consists of twenty statements (items) out of which nineteen were positive (+) statements and one were negative (-) statements. Reliability of the scale was tested by following the split half method. Likert's techniques of summated rating for ascertaining the response on the scale.

Key words: Attitude, Extension, Post graduate students, Reliability, Validity.

DEVELOPMENT OF TESTING DESIGN (SCALE) TO MEASURE ATTITUDE OF POST GRADUATE STUDENTS TOWARDS AGRICULTURAL RESEARCH

ADE ANIL 1, HINGONEKAR SAJAN 2 AND NIGADE DHANSHRI 3

DEPTT. OF EXTENSION EDUCATION, COLLEGE OF AGRICULTURE, PARBHANI, M. S.,

Due to non-availability of a proper scale to measure attitude of post graduate students towards Agricultural Research in Gujarat State, it was thought necessary to construct a scale for the purpose. Keeping this in view, an attempt has been made to develop a scale for measuring the attitude of postgraduate students. The scale consists of twenty statements (items) out of which sixteen were positive (+) statements and four were negative (-) statements. Reliability of the scale was tested by following the split half method. Likert's techniques of summated rating for ascertaining the response on the scale.

Key words: Attitude, Post graduate students, Reliability, Research, Validity.

BIOINSECTICIDES-A TOOL OF MODERN AGRICULTURE. PREETHLN.

DEPARTMENT OF AGRICULTURAL ENTOMOLOGY, SARDAR VALLABHAI PATEL UNIVERSITY OF AGRICULTURE AND TECHNOLOGY, MEERUT-250110.

Over the past 50 years, crop protection has relied heavily on synthetic chemical pesticides, but their availability is now declining as a result of new legislation and the evolution of resistance in pest populations. Biopesticides, including entomopathogenic viruses, bacteria, fungi, nematodes , and plant secondary metabolites, are gaining increasing importance as they are alternatives to chemical pesticides and are a major component of many pest control programs. The term 'biopesticide' encompasses a broad array of microbial pesticides, biochemicals derived from micro-organisms and other natural sources, and processes involving the genetic incorporation of DNA into agricultural commodities that confer protection against pest damage (plant-incorporated protectants). Biopesticides are pest management agents based on living micro-organisms or natural products. They have proven potential for pest management and they are being used across the world. However, they are regulated by systems designed originally for chemical pesticides that have created market entry barriers by imposing burdensome costs on the biopesticide industry. There are also significant technical barriers to making biopesticides more effective. The overall aim of biopesticide research is to make these biopesticide products available at farm level at an affordable price, and this would become a possible tool in the integrated pest management strategy. Studies of substantial equivalence suggest that foods currently derived from plant-incorporated protectants are not likely to differ from conventional foods. However, there is general consensus that the scientific methods to assess risks from genetically modified foods and micro-organisms will continue to evolve in the future. This paper has reviewed the important and basic defection of major biopesticides in the past. The future prospects for the development of new biopesticides are also discussed.

Key words: Biopesticide, Integrated Pest Management, Adoption, Regulation, Environment safety.

SELECTIVE LINE GENOTYPING FOR IDENTIFICATION OF MARKERS ASSOCIATED WITH HEATTOLERANCE IN RICE.

ARPITHA SHANKAR.B.

DEPARTMENT OF AGRICULTURAL BIOTECHNOLOGY, SARDAR VALLABHAI PATEL UNIVERSITY OF AGRICULTURE AND TECHNOLOGY, MEERUT- 250110.

Heat is one of the major factors that considerably limit rice production. Here we report a novel temperature induction response (TIR) technique was standardized for Rice crop. Production of rice-the world's most important crop for ensuring food security and addressing poverty will be defeated as temperatures increase in rice-growing areas with continued climate change. Climate change needs us to look at various alternatives for more drought tolerant and tougher strains and to develop a technique to screen a large number of genotypes for high temperature tolerance. By adapting TIR technique 74 genotypes were screened for thermo tolerance .Out of 74 genotypes 14 exhibits thermo tolerance due to induced high temperature. These genotypes have intrinsic heat tolerance and they can be explored as donar source in breeding programme aimed for global warming.

Keywords: Thermo tolerance, Lethal temperature, Sub - lethal temperature, Rice genotypes, Seedling survival.

INDIGENOUS TECHNICAL KNOWLEDGE (ITK) AND THEIR ROLE IN PLANT PROTECTION JAYASREE.R.

DEPARTMENT OF AGRICULTURAL EXTENSION AND COMMUNICATION, SARADAR VALLABHAI PATEL UNIVERSITY OF AGRICULTURE AND TECHNOLOGY, MEERUT-250110.

Indigenous Technical Knowledge (ITK) refers to the unique traditional local knowledge existing within and developed around the specific conditions by women and men indigenous to a particular geographical area. It is specifically concerned with actual application of the thinking of the local people in various operations of agriculture and allied areas. ITK's are based on experience, often tested over a long time of use, adopted local culture and environment ,dynamics and changing and lays emphasis on minimizing the risks rather than maximizing the profit. Role of ITK can aids development efforts, can facilitates local peoples participation, developing appropriate technologies. Scope of ITK is resource management, development planning, Environment Assessment.ITK covers wide range of subjects viz. Crop production, Livestock rearing, Natural resource management, Food preparation , Healthcare , Insect pest management and many others. The use of non-chemical methods for pest control and crop protection is already gaining importance in several countries including India. The integrated pest management strategies developed and promoted by the Government is now based on use of plant extracts. If an effort is made towards production of ITK based products on cottage scale , it can be an economically viable option for sustainable development of eco-friendly pesticides/ insecticides. Here a few examples of use of ITK in plant protection are using of neem leaves for storing rice grains to avoid store grain pests, i.e., Rice weevil, Sprinkling of ash over and around the vegetable crops like onion, okra , brinjal, tomato and cucumber and in field in effective against insect pests like beetles ,leaf defoliating insects etc,. Indigenous techniques used in different component of farming system are mostly eco-friendly, sustainable ,viable and cost effective . **Key words** : Traditional local knowledge and Peoples participation.

ASSESSMENT OF GROWTH IN SAHIWAL HEIFERS WITH FEED SUPPLEMENT AND ADDITIVES DIWAKAR VERMA¹, BRAJESH KUMAR NAMDEV² ICAR-KVK SCIENTIST(LIVESTOCK PRODUCTION & MANAGEMENT) IIVR, VARANSI

ICAR-KVK SCIENTIST(ENTOMOLOGY)

The objective of this study was to access the effects of protected fat plus yeast, niacin, zinc and chromium dietary supplementation on the growth of Sahiwal heifers. The basal ration for both the groups were same. However, the treatment group was supplemented with protected fat (2.5% of dry matter intake (DMI)), yeast (10g /animal/day), niacin (6 g/animal/day), zinc (40mg/kg DMI) and chromium (1.5 mg/kg DMI). The mean value of ADG for control and treatment groups were 545.15 ± 25.06 gm and 614.11 ± 20.33 gm, respectively and was significantly (P<0.05) higher in treatment group. The mean value of gain in heart girth for control and treatment groups were 2.38 ± 0.10 cm and 2.83 ± 0.08 cm, respectively and was significantly (P<0.01) higher in treatment group. The mean value of gain in body length for control and treatment groups were 1.42 ± 0.03 cm and 1.25 ± 0.04 cm, respectively and was significantly (P<0.05) higher in treatment groups were 1.49 ± 0.05 cm and 1.61 ± 0.06 cm, respectively (P>0.05). The overall mean value of DMI/100 kg body weight for control and treatment groups were 3.08 ± 0.05 kg and 3.14 ± 0.04 kg, respectively (P>0.05). The present study concludes that the supplementation of above feed package in the ratio of Sahiwal heifers improves the growth rate as indicated by the higher ADG, DMI and body measurement values in treatment group heifers.

Keyword: Feed additives, Growth, Heifers, Sahiwal

INFLUENCE OF MOISTURE STRESS MANAGEMENT PRACTICES ON BIOCHEMICAL PROPERTIES OF MAIZE (Zea mays L.)

RAJASEKAR M¹, PRABHAKARAN NK²

¹KUMARAGURU INSTITUTE OF AGRICULTURE, ERODE – 638 315

²AGRICULTURAL RESEARCH STATION, BHAVANISAGAR - 638 415

Field investigations were conducted in the Northern block, Agricultural Research Station, Bhavanisagar, Erode during rabi 2017-18 & 2018-19 and summer 2018 & 2019 to assess the influence of moisture stress management practices in different irrigation regimes in maize. The experiment was laid out in split plot design with three replications comprised of four irrigation regimes as main factor based on IW/CPE ratio of 1.0 (I_{1.0}), 0.8(I_{0.8}), 0.6 (I_{0.6}) and 0.4 (I_{0.4}) and four moisture stress management treatments viz., foliar application of pink pigmented facultative methylobacteria 1% (FPPFM), Brassinolide 0.1 ppm (FBr), Silicic acid 0.2% (FsI) and control (FC) as a sub factor. Foliar application was given on 25 and 45 DAS for each treatment in the sub plot. Maize cultivar CO(H)M 6 was used as a test variety spaced with 60 x 25 cm. Results revealed that, IW/CPE 0.4 registered significantly higher proline content (7.82, 7.60, 10.63 and 12.06 µg g⁻¹ respectively during rabi 2017-18 & 2018-19 and summer 2018 & 2019), catalase activity (5.09, 5.03, 5.02 and 5.70 µmol g⁻¹ min⁻¹ at 45 DAS; 4.68, 4.61, 4.61 and 5.24 µmol g⁻¹ min⁻¹ at 60 DAS respectively during rabi 2017-18 & 2018-19 and summer 2018 & 2019. and peroxidase activity (45.8, 45.2, 45.2 and 51.3 µmol g⁻¹ min⁻¹ at 45 DAS; 34.3, 33.9, 33.9 and 38.4 µmol g⁻¹ min⁻¹ at 60 DAS respectively during *rabi* 2017-18 & 2018-19 and summer 2018 & 2019) among the irrigation regimes. Remarkably lower proline content, catalase and peroxidase activity were found in IW/CPE 1.0. In moisture stress management practices, significantly higher proline content (5.57, 5.42, 7.50 and 8.40 μ g g⁻¹ respectively during rabi 2017-18 & 2018-19 and summer 2018 & 2019) was recorded in brassinolide 0.1 ppm applied plants barring control and admirably lower proline content was recorded in PPFM 1% on 25 and 45 DAS. IW/CPE 1.0 with no moisture stress management practices (Fc) recorded significantly lower proline content and was comparable with other moisture stress management treatments in IW/CPE 1.0. Distinctly higher catalase (4.39, 4.33, 4.28 and 4.77 µmol g⁻¹ min⁻¹ at 45 DAS; 4.05, 4.00, 3.96 and 4.41µmol g⁻¹ min⁻¹ at 60 DAS respectively during rabi 2017-18 & 2018-19 and summer 2018 & 2019) and peroxidase activity (39.5, 39.0, 38.5 and 42.9 µmol g⁻¹ min⁻¹ at 45 DAS; 29.6, 29.2, 28.9 and 32.2 µmol g⁻¹ min⁻¹ at 60 DAS respectively during rabi 2017-18 & 2018-19 and summer 2018 & 2019) was noticed in PPFM 1% foliar applied treatment. In interaction effect, foliar application of PPFM 1% on 25 and 45 DAS at IW/CPE 0.4 recorded lucidly higher catalase and peroxidase activity during 45 and 60 DAS. Significantly lower catalase activity was recorded in IW/CPE 0.8 (Mild stress) with control and was comparable with other treatments at IW/CPE 1.0 (No stress). Key words: Catalase, Peroxidase, Proline, H₂O₂, Silicic Acid.

ANTIBIOSIS EFFECT OF PHENOLICS (FERULIC AND P-COUMARIC ACID) ON THE BIOLOGY OF PINK STEM BORER, SESAMIA INFERENS

PRATAP A. DIVEKAR^{1*}, PRADYUMN KUMAR², SUBY S.B.³

IIVR, REGIONAL RESEARCH STATION, SARGATIA, KUSHINAGAR-274406 (U.P.) INDIA.

DIVISION OF ENTOMOLOGY, INDIAN AGRICULTURAL RESEARCH INSTITUTE, NEW DELHI-110012.

INDIAN INSTITUTE OF MAIZE RESEARCH, LUDHIANA- 141004.

Antibiosis effect of two phenolic acids (ferulic acid and *p*-coumaric acid) was studied to confirm the cause-effect relationship i.e. to evaluate the efficacy of these compounds against pink stem borer, *S. inferens* using diet incorporation method. Observations were recorded on the biological attributes of *S. inferens* viz., larval and pupal weight, percent larval mortality, percent pupation, larval and pupal period and adult emergence against different concentrations of the phenolics. For both the ferulic and *p*-coumaric acid, lowest larval weight was recorded at highest concentration (10 mg/g of diet). Lowest larval weight 8.54 mg, 45.47 mg and 92.24 mg were observed at 10 Days after Artificial Infestation (DAI), 18 DAI and 25 DAI for ferulic acid whereas 11.31, 48.67 and 83.57 mg were recorded for *p*-coumaric acid. The insects which fed on higher concentrations of phenolic acids showed a prolonged larval duration in comparison to lower concentration. A diminishing trend was observed for *S. inferens* regarding percent pupation with the increase in concentration of ferulic acid and *p*-coumaric acid, respectively. Significantly more adults emerged from lower concentrations of phenolics acids (0, 0.2 and 4 mg/g diet) whereas least adult emergence was recorded on higher concentrations (6, 8 and 10 mg/g diet). Diet incorporation assay with Phenolic acids (Ferulic and *p*-coumaric acids) revealed the antibiosis effect on *S. inferens* as both the phenolic acids adversely affected the biological attributes of pink stem borer.

IMPORTANCE OF REMOTE SENSING AND G.I.S. IN NATURAL RESOURCE MANAGEMENT GOPAL LAL DHAKER¹, DEVI LAL DHAKER², SHIVAM MAURYA³ ¹DEPARTMENT OF SOIL SCIENCE AND AGRICULTURAL CHEMISTRY, SKNAU, JOBNER, JAIPUR

²DEPARTMENT OF SOIL SCIENCE AND AGRICULTURAL CHEMISTRY, SKNAU, JOBNER, JAIPUR

Natural resources like land, water, forest, biodiversity etc. are essential to the economy of a nation. However, it is essential for nations to learn how to use these resources in a sustainable manner to ensure that their benefits are enjoyed in the present as well as future generations. At the present moment, the utilization of the resources present in the world has been overstretched due to the ever rising population of human beings. There is a dire need to ensure that these resources are effectively managed. A lot of management practices have been advanced in the field of natural resource managed to achieve this goal. However, with the current trend in the advancement in the field of information technology, natural resource managers have now laid a lot of emphasis on the use of remote sensing and GIS technologies in the management of natural resources. These technologies provide a platform through which managers can generate informative data and information that can be used to make sound decisions for sustainable development. Remote sensing and Geographical Information System (GIS) offers an abundant opportunity to monitor and manage natural resources at multi-temporal, multi-spectral and multi-spatial resolution. The integrated use of remotely sensed data, GPS, and GIS will enable consultants and natural resource managers and researchers in government agencies, conservation organizations, and industry to develop management plans for a variety of natural resource management applications. It is a potential tool to study change in land cover, forest density, coastal morphology, status of reef and biodiversity of islands even if, located in remote place. In natural resource management, remote sensing and GIS is mainly used in the mapping process, Forest and wildlife Management, Watershed Management, Combat Desertification, Biodiversity Management, Natural Disaster Management, agricultural management like Crop Modeling, Crop-Irrigation Demand Monitoring, disease and pest intensity Monitoring etc. However, remote sensing and GIS can be used to manage these limited resources in an effective and efficient manner. Geospatial data are effective in the analysis and determination of factors that affect the utilization of these resources. Hence, with the detailed understanding of these factors, sound decisions can be arrived at that will ensure the sustainable use of natural resources to meet the needs of the current as well as future generations.

Key words: - remote sensing, natural resource, geographical information system, management

EFFECT OF *MELOIDOGYNE GRAMINICOLA* ON SOME PHYSIOLOGICAL PARAMETERS IN RESISTANT AND SUSCEPTIBLE HYBRIDS OF PEARL MILLET

GURPREET SINGH¹, R S KANWAR¹ AND RENU MUNJAL²

¹DEPARTMENT OF NEMATOLOGY, CCS HARYANA AGRICULTURAL UNIVERSITY HISAR

²DEPARTMENT OF BOTANY AND PLANT PHYSIOLOGY, CCS HARYANA AGRICULTURAL UNIVERSITY HISAR

Investigations were carried out to study the effect of *Meloidogyne graminicola* on some physiological alteration produced in resistant and susceptible hybrids of pearl millet. *M. graminicola* resistant (HHB 146) and susceptible (HHB 272) were grown in 1 kg soil capacity earthen pots under screen house conditions. The plants were inoculated with 2000 eggs and J_2 of *Meloidogyne graminicola* at 10 days after sowing and chlorophyll a, chlorophyll b, carotenoids, chlorophyll fluorescence and normalized difference vegetation index (NDVI) were recorded in shoots at 15, 30 and 45 days after inoculation. Per cent decrease in chlorophyll fluorescence and NDVI was recorded in inoculated plant over uninoculated plants at all the observation period, however, maximum per cent reduction in chlorophyll fluorescence was found at 30 days after inoculation. In the experimentation, per cent decrease in chlorophyll fluorescence and NDVI was much higher in susceptible plants as compared to resistant plants. Chlorophyll a was reduced in inoculated plant as compared to uninoculated plants and this decrease was higher with the advancement of plant age. Maximum per cent decrease in chlorophyll a was recorded at 45 DAI in susceptible inoculated plants. Chlorophyll b was also reduced with the passage of time, however, at 45 DAI chlorophyll b was recovered upto some extent in resistant and susceptible plants. Maximum per cent decrease in chlorophyll b was recorded in susceptible inoculated plants at 30 DAI. Carotenoid content in both the hybrids was decreased and maximum per cent reduction in carotenoid was recorded in susceptible plant at 15 DAI.

Keywords: Meloidogyne graminicola, pearl millet, physiological change and NDVI

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EFFECT OF MELOIDOGYNE GRAMINICOLA ON SOME BIOCHEMICAL PARAMETERS IN RESISTANT AND SUSCEPTIBLE HYBRIDS OF PEARL MILLET

GURPREET SINGH¹, R S KANWAR¹ AND L K CHUGH²

¹DEPARTMENT OF NEMATOLOGY, CCS HARYANA AGRICULTURAL UNIVERSITY HISAR

²DEPARTMENT OF BIOCHEMISTRY, CCS HARYANA AGRICULTURAL UNIVERSITY HISAR

Investigations were carried out to study the effect of Meloidogyne graminicola on some biochemical alteration produced in resistant and susceptible hybrids of pearl millet. M. graminicola resistant (HHB 146) and susceptible (HHB 272) were grown in 1 kg soil capacity earthen pots under screen house conditions. The plants were inoculated with 2000 eggs and J_2 of *Meloidogyne graminicola* at 10 days after sowing and total protein, phenol and sugars were recorded in roots and shoots at 15, 30 and 45 days after nematode inoculation. As compared with uninoculated plants protein content was increased more in roots of susceptible hybrids than resistant hybrid. Maximum per cent increase in protein content of shoot was observed in susceptible hybrid at 30 DAI. Similarly, maximum per cent increase in protein content of roots was observed in susceptible hybrid at 30 DAI. Contrary to it, phenol content in root and shoots increased more in resistant hybrid as compared to susceptible hybrid. At all the observation periods, phenol content was higher in resistant plants as compared to susceptible plants. This indicates that phenol has a major role in providing resistance against Meloidogyne graminicola. Total sugars in shoot portion decreased in both the hybrids while increased in the infected roots. Per cent decrease in total sugar content in shoots was reduced with passage of time. Increase in the total sugar of roots of susceptible hybrid was much higher than the resistant hybrid. Keywords: Biochemical alteration, M. graminicola, pearl millet, total protein, phenol and sugars

EFFECT OF INSECTICIDAL SPRAYS ON POPULATION OF NATURAL ENEMIES IN LABLAB BEAN ECOSYSTEM G. M. GOLVANKAR^{1*}, A. L. NARANGALKAR², V. S. DESAI³ AND K. V. NAIK⁴ DEPARTMENT OF AGRIL. ENTOMOLOGY, COLLEGE OF AGRICULTURE, DAPOLI,

DR. BALASAHEB SAWANT KONKAN KRISHI VIDYAPEETH, DAPOLI 415 712, DIST. RATNAGIRI (M.S.)

The present investigation was carried out to study the effect of insecticidal spray on population of natural enemies in lablab bean ecosystem during Rabi season of 2017-18 and 2018-19 at Botany farm, College of Agriculture, Dapoli. The results indicated that the mean population of coccinellids during both of the years was highest (13.37) coccinellids population plant⁻¹ recorded in treatment T_9 (Control water spray) which was significantly superior over rest of the treatments. The mean population of mirid bugs during both of the years was revealed that the highest (11.33) mirid bug population plant⁻¹ recorded in treatment T_9 (Control water spray) which was significantly superior over the rest of the treatments and at par with treatment T_2 (Azadirachtin 10,000 ppm) recorded 9.87 mirid bugs plant⁻¹. The mean population of spiders and syrphids during both of the years was revealed that the highest (18.97) spider population plant⁻¹ and (12.33) syrphids plant⁻¹ recorded in treatment T₉ (Control water spray) which was significantly superior over rest of the treatments.

Keywords: Lablab bean, natural enemies, insecticide effect.

EVALUATION OF ENTOMOPATHOGENIC FUNGI AND BOTANICALS FOR THE MANAGEMENT OF MEALYBUG V. V. CHAUDHARI¹, V. S. DESAI², N. S. DALVI^{3*} AND G. M. GOLVANKAR⁴

DEPARTMENT OF AGRIL. ENTOMOLOGY. COLLEGE OF AGRICULTURE. DAPOLI.

DR. BALASAHEB SAWANT KONKAN KRISHI VIDYAPEETH, DAPOLI 415 712, DIST- RATNAGIRI (M.S.)

The present investigation on evaluation of entomopathogenic fungi and botanicals for the management of mealybug was carried out at Biological control Laboratory, Department of Agril. Entomology, College of Agriculture, Dapoli. Mealybugs are called as hard to kill pest. For the management of mealybugs higher concentration of insecticides has to be used that may pose various problems. Use of biopesticides may become safer option. The efficacy of different entomopathogenic fungi and botanicals on mealybugs ten days after treatment revealed that the maximum mean mortality of 90.00 per cent was recorded in the treatment (T₃) V. lecanii @ 10⁹ cfu/ml followed by treatment (T₂) V. lecanii @ 10⁸ cfu/ml and (T₇) V. lecanii @ 5 gm/lit. water which recorded 85.00 and 80.00 per cent mean mortality respectively and were at par with each other.

Keywords: Mealybug, entomopathogenic fungi, V. lecanii

SCREENING OF DIFFERENT CULTIVARS OF BRINJAL AGAINST SHOOT AND FRUIT BORER, LEUCINODES **ORBONALIS GUENEE**

PRITI S. SHIGWAN^{1*}, A. L. NARANGALKAR², V. S. DESAI³, B. D. SHINDE⁴ AND G. M. GOLVANKAR⁵ DEPARTMENT OF AGRIL. ENTOMOLOGY, COLLEGE OF AGRICULTURE, DAPOLI

DR. BALASAHEB SAWANT KONKAN KRISHI VIDYAPEETH, DAPOLI 415 712, DIST. RATNAGIRI (M.S)

The field experiment was conducted to study the screening of different cultivars of brinjal against shoot and fruit borer, Leucinodes orbonalis Guenee during rabi season of 2017-2018 at Central Experimental Station, Wakawali, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli. Twenty three cultivars were evaluated against brinjal shoot and fruit borer under field condition. The crop was observed to be free of shoot infestation throughout the crop period. The data on overall mean infestation of brinjal shoot and fruit borer was in range of 7.26 to 34.36 per cent. The maximum per cent infestation (34.36 ± 7.77) was noticed in the DPLBR-14. The minimum per cent infestation (7.26 \pm 7.77) was recorded in cultivar SM-6-6. The results revealed that on the basis of per cent infestation scale, none of the cultivar was free from shoot and fruit borer infestation. The cultivars BB-54, Singnath, SM-6-6 and DPLBR-18 were categorized as highly resistant whereas the cultivars Bholanath, PPC, BB-64, Kali Rawai, Konkan Prabha, DPLBR-16 and DPLBR-17 were categorized as fairly resistant. The cultivars Swarna Pratibha, BB 60C, Arka Nilkanth, CHES-249, Arka Nidhi, DPLBR-9, DPLBR-10, DPLBR-12, DPLBR-13 and DPLBR-15 were categorized as less resistant whereas the cultivars DPLBR-11 and DPLBR-14 were categorized as susceptible. Key words: Screening, Brinjal shoot and fruit borer, Leucinodes orbonalis Guenee.

EFFICACY OF SOME INSECTICIDES AGAINST MELON FRUIT FLY, *BACTROCERA* SPP. ON BITTER GOURD SONALI S. LAD¹*, K. V. NAIK² AND G. M. GOLVANKAR³

DEPARTMENT OF AGRIL. ENTOMOLOGY, COLLEGE OF AGRICULTURE, DAPOLI,

DR. BALASAHEB SAWANT KONKAN KRISHI VIDYAPEETH, DAPOLI 415 712, DIST- RATNAGIRI (M.S.)

The present investigation was carried out to study the efficacy of some insecticides against melon fruit fly, *Bactrocera* spp. on bitter gourd during *rabi-summer* season of 2017-18 at Centre of Excellence for Mango, College of Agriculture, Dapoli, Dist. Ratnagiri (M.S). The results indicated that the efficacy of treatment spinosad 45 SC @ 0.014 per cent was found effective against fruit flies which recorded minimum (16.69%) mean fruit infestation and was at par with emamectin benzoate 5 SG @ 0.002 per cent (20.26%). The next effective treatment was chlorantraniliprole 18.5 SC @ 0.005 per cent with 26.84 per cent fruit infestation. Whereas, the maximum (71.37%) mean fruit infestation was noticed in untreated control plot.

Keywords: Melon fruit fly, *Bactrocera* spp., bitter gourd, insecticide efficacy.

EFFECT OF DIFFERENT FERTILIZER LEVELS AND VARIOUS MULCHES ON OKRA SHOOT AND FRUIT BORER INFESTING OKRA

AJITH KUMAR BUGADA¹*, A. Y. MUNJ², V. S. DESAI³ AND G. M. GOLVANKAR⁴ DEPARTMENT OF AGRIL. ENTOMOLOGY, COLLEGE OF AGRICULTURE, DAPOLI

DR. BALASAHEB SAWANT KONKAN KRISHI VIDYAPEETH, DAPOLI 415 712, DIST. RATNAGIRI (M.S.)

The present studies were undertaken at Agronomy farm, College of Agriculture, Dapoli during *rabi* 2018-19 to evaluate the effect of different fertilizer levels and various mulches on okra shoot and fruit borer infesting okra in the *rabi*- summer. Results on effect of different levels of fertigation on fruit and shoot borer infesting okra at 10^{th} and 13^{th} picking showed that the treatment F₁ (120% RDF through fertigation in 14 splits) was found to be the effective treatment by recording 7.53 and 7.19 per cent fruit borer infestation per plot. Whereas, data on effect of different mulches on infestation of fruit borer showed that during 20^{th} picking the infestation (8.70%) was found in the treatment M₃ (Paddy straw mulch) which was at par with treatment M₄ (no mulch) which recorded 10.29 per cent of fruits infested with fruit borer. While, the results on combination effect of fertigation and mulches on fruit borer infestation recorded during 12^{th} picking was lowest (7.41%) in treatment F₃M₁ (80% RDF through fertigation + Black polythene mulch) which was at par with the treatments F₁M₂, F₁M₃, F₂M₁, F₂M₂, F₂M₃, F₃M₂, F₃M₃, F₄M₁ and F₄M₂ which recorded 9.97, 9.77, 8.68, 8.19, 9.04, 8.50, 9.77, 8.95 and 9.60 per cent fruit borer infestation, respectively. During 15^{th} picking the lowest per cent infestation (6.69) was observed on the treatment combination F₃M₄ (80% RDF through fertigation + No mulch) which was at par with F₄M₂, F₁M₃, F₂M₄, F₂M₂, F₃M₁, F₄M₄, F₂M₁, F₃M₂, F₃M₄, F₂M₁, F₃M₂, F₃M₄, F₂M₄, F₂M₁, F₃M₂, F₃M₄, F₂M₄, F₂M₁, F₃M₂, F₁M₄ and F₂M₃ which recorded 8.06, 8.83, 9.00, 9.35, 9.48, 9.64, 9.82, 10.90, 11.10, 11.26, 12.08, 12.27 and 13.28 borer per cent infestation, respectively.

Key words: Mulch, fertigation, fertilizer levels, okra shoot and fruit borer, Earias spp.

INFLUENCE OF SOWING DATES AND MULCHES ON THE INCIDENCE OF JASSID IN OKRA ECOSYSTEM

SHRADDHA S. DAHIVALKAR¹*, V. S. DESAI², G. M. GOLVANKAR³ AND P. B. SHINDE⁴ DEPARTMENT OF AGRIL. ENTOMOLOGY, COLLEGE OF AGRICULTURE, DAPOLI DR. BALASAHEB SAWANT KONKAN KRISHI VIDYAPEETH, DAPOLI. DIST. RATNAGIRI- 415712 (M.S.)

The present investigation was conducted to study on the influence of sowing date and mulches on the incidence of jassid in okra ecosystem during *rabi* hot weather season of 2016-2017 at Agronomy farm, College of Agriculture, Dapoli. The results indicated that the data on effect of different sowing dates on mean jassid population during 4th, 5th, 6th, 7th, 8th and 9th Week after sowing (WAS), was minimum (2.12, 3.44, 6.55, 4.22, 2.21 and 0.96, respectively) in treatment S₁ (46th SMW, 12th-18th Nov.) and was at par with S₂. The data on effect of different mulches on mean jassid population during 4th, 5th, 6th, 7th and 8th WAS, was minimum (0.02, 4.58, 7.29, 4.76 and 3.04, respectively) in treatment M₂ (Silver polythene mulch) which was at par with M₃. The data on combination effect of different sowing dates and mulches on mean jassid population during 4th, 5th, 6th, 7th and 9th WAS, was minimum (1.05) in treatment combinations S₁M₂ [S₁ (46th SMW, 12th-18th Nov.) + M₂ (Silver polythene mulch)] and S₂M₂ [S₂ (49th SMW, 3rd-9th Dec.) + M₂ (Silver polythene mulch)]. **Key words:** Sowing date, jassid, *Amrasca biguttula biguttula* (Ishida), mulch.

STANDARDIZING MASS QUEEN REARING TECHNIQUES IN INDIAN HONEY BEE, APIS CERANA INDICA F.

¹C.SOWMIYA*, ²DR.M.R. SRINIVASAN, ³DR.P.A. SARAVANAN AND ⁴ S. VASANTHAKUMAR ^{13 4} AC&RI, COIMBATORE ²AC&RI, WILL MALL, M. TNALL

²AC&RI, KILLIKULAM, TNAU.

Queen honey bee is the mother of the colony which ruled over workers. As it is the source of all the hereditary characters, the colony can be improved by producing good quality queen. *Apis cerana indica* is present throughout our country except for plains of north India. Its life cycle is very similar to *A. mellifera*. But there were no ample studies on queen rearing in Indian honey bees compared to Italian bees. The techniques comprised optimization of queen cell cup size, type and quality of the priming material. Queen cell cups of different sizes including 4 mm, 5 mm, 6 mm and 7 mm in diameter were used. Among them, 7 mm diameter cup showed the highest larval acceptance (28.33%) and adult emergence (25 %) next by 6 mm diameter cup (10% larval acceptance and 8.33 % adult emergence). Five types of priming media were compared including Water priming, Royal jelly priming, Diluted royal jelly priming, Honey priming and Honey + Royal jelly priming. Among them diluted royal jelly showed the highest acceptance with 29.2% acceptance and 27.1 % adult emergence (3.3/12 cups) followed by royal jelly priming (16.7 % and 12.5%), Honey + royal jelly priming (10.4 % and 6.5 %), Honey priming (8.3 % and 4.2 %) and water priming (2.1 %). The queen cell cups were prepared artificially from plastic cups also. But they were not readily accepted by worker bees of *A.cerana indica*. Hence it is important to standardize queen rearing methodology in *A.cerana indica* in order to multiply a large number of queens and supply colonies of superior character to beekeepers in India.

DEVELOPMENT OF BANANA BASED VALUE ADDED READY TO SERVE DRINK WITH NATURAL PRESERVATIVES <u>SIMRAN ARORA</u>, SALEEM SIDDIQUI, RAKESH GEHLOT AND NASEER AHMED

CENTRE OF FOOD SCIENCE AND TECHNOLOGY, CCS HARYANA AGRICULTURE UNIVERSITY, HISAR, HARYANA The present investigation was carried out to develop and evaluate ready-to-serve (RTS) banana based drink having 20% pulp, 15% TSS and 0.28% acidity. The objectives of this study is to study the effect of various natural preservatives on the shelf life of developed ready-toserve drink. Fresh carrot, beet root juices and ripe or over-ripe banana pulp were utilized for preparation value added ready to serve (RTS) drinks. The RTS drink variants were bottled in 200 ml capacity sterilized glass bottles, pasteurised and stored for three months at room temperature (25+2°C) for analysing its quality and sensory attributes at monthly intervals for three months. The value added RTS drink variant with 20% banana pulp, 15% TSS, 0.28% acidity, 0.68% spice mixture and carrot + beetroot (9:1) juice @ 50% was found to be most acceptable. Among the various preservatives used, it was observed that sodium benzoate @ 100ppm and nisin @ 40 mg/l were most acceptable on the basis of sensory scores of RTS drinks. There was an increase in TSS, total and reducing sugars, acidity, and nonenzymatic browning, while a decrease was observed in pH, ascorbic acid, total carotenoids, phenols, anthocyanins, betanins and total antioxidants of RTS drink variants during storage. The total plate counts (TPC) during storage were lower in RTS drinks containing preservatives were microbiologically safe upto two months only and became unsafe by three month of storage. The retention of organoleptic overall acceptability scores during storage was higher for value added RTS drinks containing natural preservative nisin. **Key words:** Banana pulp, carrot juice, beet root juice, RTS drink, natural preservatives

APPLICATION OF RENEWABLE ENERGY FOR WATER DESALINIZATION

NEHA SINGHAL*¹, MUKESH SIAG²

*¹ICAR-INDIAN AGRICULTURAL RESEARCH INSTITUTE, NEW DELHI ²PUNJAB AGRICULTURAL UNIVERSITY, LUDHIANA, PUNJAB

Desalination is an energy intensive process, which consume high grade energy like gas, electricity, oil and fossil fuels. The high level consumption of energy makes this process very costly. Energy accounts for 50-60% of the total cost of water desalinization plant. Use of such energy sources leads to carbon footprints, depletion of ozone layer, global warming, health hazards and becomes threat to life sustainability. These problems associated with the use of non-renewable energy sources could be resolved by utilization of renewable resources such as solar, biomass, wind, or geothermal energy. The potential of harnessing solar energy is most efficient and effective for heat to heat conversion. India, being a tropical country is blessed with plenty of sunshine. The average daily solar radiation varies between 4 and 7 kWh per square meter for different parts of the country. We receive about 5000 trillion kWh solar energy in a year. Solar desalination can either be direct; use solar energy to produce distillate directly in the solar collector, or indirect; combining conventional desalination (MD) and electro dialysis, with solar collectors for heat generation. Solar desalinization plants are simple, cost-effective, and environment friendly, have low operation cost. These can be used for small-scale production, especially in remote arid areas and islands, where the supply of conventional energy is scarce. But some drawbacks are low productivity rate and low thermal efficiency. GOI is focusing on utilising the renewable energy potential for sustainable development.

Keywords: Renewable Energy, Solar, Wind, Desalinization, Water etc.

POTENTIAL OF NEUTRACITICAL AND NEGLECTED CROPS TO COPE UP OF CLIMATE CHANGE AND FOOD SECURITY FOR THE FUTURE

PIYUSHA SINGH¹, AKANKSHA TIWARI¹ AND VIMLESH KUMAR²

1DEPARTMENT OF GENETICS AND PLANT BREEDING, 2 DEPARTMENT OF HORTICULTURE, COLLEGE OF AGRICULTURE NDUAT CAMPUS AZAMGARH UP INDIA

Millets and Underutilized crops play an important role in food security, nutrition, and income generation of many resource-poor farmers and consumers especially in the developing world. Dependence on a few major crops remains a major challenge due to its potential impact and contribution to food security. Higher temperatures, unpredictable rainfall and weather patterns, changes in growing seasons, increased occurrences of drought and extreme weather events will exert a greater strain on agriculture. Some of Underutilized crops are grain amaranth, buckwheat, rice bean, adzuki bean, chenopods and some of the millets are finger millets, barnyard millet, Proso millet etc. These crops have high nutritional values, forage importance and grown in marginal land without much agricultural inputs. These crops require less water and able to defend themselves according to natural calamities. Emerging evidence suggests that climate change will cause shifts in food production and yield loss due to more unpredictable and hostile weather patterns. There is now an increasing realization of this fact, and a greater awareness that these crops merit more research and development. The growing demand for food and a variety of food products also calls for interest and investment in underutilized and millets crops by scientist, people and peasants. Underutilized and millets, therefore hold the key to the future of mankind. They are the 'Potential food crops of tomorrows' world.

Key words: Underutilized and millets

EFFECTIVENESS OF WELFARE PROGRAMS ON NUTRITIONAL SECURITY OF FARM WOMEN: A STUDY IN COASTAL ODISHA

C. DEVADARSHINI, D. JENA AND S .NANDA

DEPT. OF FOODS AND NUTRITION, COLLEGE OF COMMUNITY SCIENCE, OUAT

Food security is the core afflictions of poor people and it became a chronic condition for farmers of India. The women are the backbone of agricultural workforce. Several government programs were going on for involvement of the poor farmers especially aimed at providing nutritional stability and food security through generation of income to the village households. The present study was carried out to assess the effectiveness of welfare programs on nutritional security of women in agriculture sectors in the selected coastal districts of Odisha during the year 2013-2016. MGNREGA(Mahatma Gandhi National Rural Employment Guarantee Act) was found to be most popular among farmers and it was directly related to income of the target groups. The inclusion criteria was that the households having a married couple with minimum family size of 4 members and the respondent is engaged in agricultural activity aging more than 35 years. Thirty

samples from each groups were selected randomly from the MGNREGA and Non-MGNREGA groups so a total 60 samples were selected in the study. We observe significant difference in means between the groups both for income (t= 4.38^{*} , p<0.05) and expenditure (t= 3.47^{*} , p<0.05). The mean BMI of Non-MGNREGA was lower (16.00 ± 1.38) than the MGNREGA (19.37 ± 2.71) groups. Nutritional status like intake of energy, protein and folic acid was statistically significant in MGNREGA households compared to non-MGNREGA households (p<0.05%). From the study it was clear that MGNREGA had a positive impact on the income of the respondents ultimately leading towards nutritional security.

Key words: Nutritional Security, BMI, MGNREGA

MENTAL HEALTH STATUS OF ADOLESCENTS ACROSS GENDER

VANDANA¹ AND KRISHNA DUHAN²

DEPARTMENT OF HUMAN DEVELOPMENT AND FAMILY STUDIES, COLLEGE OF HOME SCIENCE, CHAUDHARY CHARAN SINGH HARYANA AGRICULTURAL UNIVERSITY, HISAR (125004)

Mental Health is defined as a state of emotional and psychological well-being in which an individual is able to use his or her cognitive and emotional capabilities, function in society and meet the ordinary demands of everyday life. The study aimed to assess the mental health status of adolescents across gender and association of mental health with personal and socio-economic variables in Hisar city of Haryana state. A total sample of 200 respondents was taken randomly in the age group of 16-18 years i.e. 100 respondents from rural and 100 respondents from urban area. To draw rural sample government senior secondary school from 'Dobhi' village was taken randomly and to have the urban sample two schools i.e. government girl's senior secondary school, Sushila bhawan and government senior secondary school, Jhajpool were selected randomly. With regards to gender, equal sample size was taken. Tool used for the research was mental health battery by Singh and Gupta (1983). Research findings revealed that72 per cent rural female respondents had good mental health. Majority of urban male respondents (62%) had good mental health than female respondents whereas, 62 per cent urban female respondents. Significant mean differences was observed in rural male and female (9.36*) respondents. Results also revealed a significant association of mental health with occupation of father ($x^2=16.80^*$), caste ($x^2=11.00^*$) and monthly income ($x^2=11.72^*$) of the family.

Keywords Adolescents, Mental Health, Gender, Cognitive, well-being.

EXPLORATION OF CONIDIAL FUNGI FROM SOME WATER BODIES OF NAINITAL DISTRICT (KUMAUN HIMALAYA) RUCHI JALAL¹, SARASWATI BISHT¹, SAIMA ALTAF¹, ANJALI TIWARI¹

¹DEPARTMENT OF BOTANY, I.P.G.G.P.G. COLLEGE OF COMMERCE, HALDWANI, NAINITAL

The fresh water ecosystem harbours a variety of micro-organisms, among which aquatic hyphomycetes occupy an important place. These fungi have branched and septate mycelium which colonizes the leaf litter present in running waters and release conidia of magnificent shapes (triradiate, tetraradiate, sigmoid, helical, spiral etc.). Colonization by these fungi renders leaves more palatable and nutritious to invertebrates and play important role in maintaining the energy budget of fresh water ecosystem. These fungi are not only unique in their habitat but also are the bio monitors of aquatic ecosystem as these are almost absent in polluted or stagnant water bodies. Being a significant part of aquatic biology, these fungi are need to be investigated from unexplored water bodies. Kumaun Himalaya, a temperate climatic zone with many water bodies at different altitudes having rich source of substrate pool provides suitable habitat for the growth of diversified forms of aquatic hyphomycetes. Thus, the present investigation aims to find out the diversity of conidial aquatic fungi from different unexplored fresh-water bodies of Kumaun Himalaya along an altitudinal range of 500 m to 1500 m. Decomposed leaf litter was collected periodically from the month of February to September and brought to laboratory for further processing and incubated for sporulation, isolation and identification. Altogether, twelve species of aquatic hyphomycetes were isolated and identified namely, Anguillospora crassa Ingold, Anguillospora longissima Ingold, Alatospora acuminata Ingold, Beltrania sp., Penzig, Clavariopsis aquatica de Wildemann, Cylindrocarpon aquaticum Nilsson, Helicomyces roseus Link, Lunulospora curvula Ingold, Lunulospora cymbiformis Ingold, Setosynema isthmosporum Shaw and Sutton, Tetracladium marchalianum de Wildemann, Triscelophorus sp. Ingold. Among these Tetracladium marchalianum was found to be the most common and tolerant species in all the three seasons winter, summer and rainy. Keywords: Aquatic Hyphomycetes, Diversity, Decomposition, Submerged leaf litter, Pollution indicators.

SOCIO-ECONOMIC ANALYSIS OF FLOODS IN KERALA-2018

SREEPRIYA P, R.BALASUBRAMANIAM

*DEPARTMENT OF AGRICULTURAL ECONOMICS, TAMIL NADU AGRICULTURAL UNIVERSITY, COIMBATORE-641003 (CORRESPONDING AUTHOR)

**AC AND RI VAZHAVACHANUR, TAMIL NADU AGRICULTURAL UNIVERSITY, THIRUVANAMALAI

Kerala (India) experienced the worst flooding in the century, declared a level 3 calamity where one sixth of the population was directly affected. The present study was conducted (i) to study the extent and pattern of damage caused by flood in the individual households and (ii) to examine the factors affecting the degree of resilience among the individuals. Resilience is now commonly understood as the ability of a system (individual, household, community or society) to withstand, recover or even become stronger from exposure to critical incidents or shocks. Primary data were collected from two worst affected districts Alleppey (Kuttanad) and Idukki. Multinomial logit regression model was used to assess the factors affecting post flood resilience among individual households. Factors considered were education (year of schooling), annual income, damage cost, income sources and social support. Average damage cost was found to be 13.36 lakhs in Idukki which was affected by flooding as well as landslides and 2.82 lakhs in Kuttanad. Relative loss which is the average damage cost as percentage of annual average income was found to be 364 for Idukki and 102.24 for Kuttanad. Income generation post flood was found to be affected by the type of occupation. Forty four per cent of the respondents were solely dependent on farming in Idukki where 48% of the respondents could not generate any income post flood. In case of Kuttanad, only 20 % of respondents solely depend on farming and 26 % were unable to generate any income post disaster. Thirty six per cent of the respondents in Idukki and 46 % in Kuttanad generated income less than pre flood situation. Estimates of multinomial logit regression showed education and damage cost were the significant factors affecting medium resilience where as in case of higher resilience in addition annual income was also found to be

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significant. The study also implied inadequacy in disaster warning, insurance penetration and ensuring financial aid considering the extent of damage and the economic status.

Key words: Kerala Floods, Relative loss, Resilience, Damage cost

ADVANCES IN MICRO IRRIGATION SUDHAKAR RAJ D¹, SHANKAR YADAV¹, BHAWANA¹ ¹DEPARTMENT OF SOIL AND WATER ENGINEERING, DR. RAJENDRA PRASAD CENTRAL AGRICULTURAL UNIVERSITY, PUSA, SAMASTIPUR.

In India, nearly 10 million hectares of land are covered by micro irrigation. Although the water use efficiency of micro irrigation is approximately 80 to 95 percentage, the micro irrigation farmers facing the problem of operating the systems while they are in remote areas. Hence, as a solution, automation systems are taking part in micro irrigation. This concept is relatively new, but day-by-day the necessity of automation is increasing. The types of automated farming system, function of different components (Sensors, Controllers, Control Valves etc.,) in automated system, emerging technologies and leading producer companies in micro irrigation are elaborated. As a result, the precision and flexibility in operation, nutrient use efficiency and crop yield is showing a rapid increase. **Key words:** micro irrigation, automation system, emerging technologies

TRAINING NEED OF FARMERS TOWARDS BENEFITS OF VALUE ADDITION IN HORTICULTURE AND VEGETABLE CROPS

SONIA RANI, P.S.SHEHRAWAT AND JOGINDER SINGH MALIK

DEPARTMENT OF EXTENSION EDUCATION, CCS HARYANA AGRICULTURAL UNIVERSITY, HISAR – 125004 (HARYANA), INDIA

Value addition in agriculture predominantly offers a means to increase, rejuvenate and stabilize farm income. Value-added agriculture is fundamentally market-driven. It needs trained and skilled manpower to cope with the demand of rapidly changing markets. The present study was conducted in Haryana state and two districts Hisar from southwest and Sonipat from northeast were selected, purposively. From each district, three blocks were selected randomly. Further, three villages were selected from each block making a total of 18 villages. From each village, ten farmers were selected randomly, making a total sample of 180 farmers. Hence, one hundred eighty farmers were interviewed for the study. It was found from the study that majority of the respondents were interested in taking training of 'Farm level packaging and storage' and 'Development of commercial horticultural nursery for fruit trees and vegetables crops' with mean score of 2.26 and 2.22. It was found that majority of the respondents were interested in taking training on 'Processing and value addition', 'Packaging of nursery plants' and 'Off seasonal vegetable production in polyhouse and nethouse by using precision farming' with mean score of 2.65, 2.61, 2.54 and 2.22. To reach the results aggregates total was calculated for each statement separately and on the basis of calculated scores, mean scores and mean score percentage were obtained which were ranked according to their maximum to minimum mean score percentage for assessing the knowledge level of the farmers.

Keywords: Knowledge, Farmer and Benefits

STUDIES ON FOLIAR FUNGAL DISEASES OF GERBERA (GERBERA JAMESONII)IN HIGH HUMID CONDITION OF ASSAM

BISHAL SAIKIA¹, NIRMAL MAZUMDER AND P. DUTTA

DEPARTMENT OF PLANT PATHOLOGY, ASSAM AGRICULTURAL UNIVERSITY, JORHAT7850123, ASSAM

Floriculture is the fastest growing sector in North Eastern Region of India including Assam. Among economically important flowers, marigold (*Tagetes erecta*), gladiolus (*Gladiolus grandiflorus*), tuberose (*Polyanthus tuberosa*), anthurium (*Anthurium andrenum*), gerbera (*Gerbera jamesonii*) etc are commercially cultivated in Assam. Like field crops, incidence of different diseases in gerbera including other important flower crops have also been observed. Hence to record the incidence of different foliar fungal diseases followed by the identification of causal organisms on field grown as well as protected cultivated gerberas, a random survey covering three major argoclimatic zones of Assam viz. Upper Brahmaputra Valley Zone, Lower Brahmaputra Valley Zone and Hills zone was conducted. Incidence of light brown to deep brown coloured leaf spots and blight disease (12.33- 45.00%) were predominantly recorded in almost all the gerbera varieties studied. Six numbers of fungal pathogens viz. Alternaria alternata, Collectorichum gloeosporioides, Botrytis cinerea, Ascochyta gerberae, Botryodiplodia theobromae and Fusarium oxysporum were isolated from the infected gerbera leaves. Among the encountered foliar fungal diseases, botrytis blight was the most serious (40.50-45.00%) PDI) both in open and protected condition, particularly in Hajo area of Kamrup followed by Jorhat and Karbi Anglong districts of Assam.

Key words: Gerbera, fungal disaeses, Assam

A OVERVIEW OF SOLAR TRACKING SYSTEM

EKTA SHARMA ,SHISHRI KUMAR KAUSAL & DR. RATANKIRAN WANKHADE DEPARTMENT AERONATUTICAL ENGG, APPLIED SCIENCE FEROZE GANDHI INSTITUTE ENGINEERING AND TECHNOLOGY ,RAEBARELI,UTTAR PRADESH -229001 GB PANT UNIVERSITY, PANT NAGAR,UTTERAKHAND -263145

Trackers direct solar panels or modules toward the sun. These devices change their orientation throughout the day to follow the sun's path to maximize energy capture. Sunlight has two components, the "direct beam" that carries about 90% of the solar energy, and the "diffuse sunlight" that carries the remainder – the diffuse portion is the blue sky on a clear day, and is a larger proportion of the total on cloudy days. As the majority of the energy is in the direct beam, maximizing collection requires the Sun to be visible to the panels for as long as possible. However, on cloudier days the ratio of direct vs. diffuse light can be as low as 60:40 or even lower. There are also several methods of driving solar trackers. Passive trackers move from a compressed gas fluid driven to one side or the other. Motors and gear trains direct active solar trackers by means of a controller that responds to the sun's direction. Finally, a chronological tracker counteracts the Earth's rotation by turning in the opposite direction. The purpose of solar tracking system is to obtain optimization of captured energy.

Solar tracker allows more energy to be captured and by the solar panel produced because the solar array is able to remain aligned to the sun since fixed facing of solar panel is widely used and may not effective for high power consumption. The average solar energy harvested by the conventional solar panels during the course day is not always maximized which is due to the static placement of the panel which limits their area of exposure. From the point of this review, it was obvious that the research through the invention of the solar tracking system including the improving system for obtaining optimum sun energy are very much recommended as tracking of sun position could be performed via many methods.

Keyword: solar tracker, solar tracking system

THERMODYNAMIC AND KINETIC STUDIES FOR ENVIRONMENTALLY FRIENDLY BIOSORPTION OF Pb (II) USING RUBUS ELLIPTICUS AND MYRICA ESCULENTA BIOMASS

RAJESH KUMAR¹, HARISH SHARMA¹, S. K. JOSHI¹, N. S. BHANDARI¹, N. D. KANDPAL¹

¹**DEPARTMENT OF CHEMISTRY, KUMAUN UNIVERSITY, S. S. J. CAMPUS, ALMORA-263601, UTTARAKHAND, INDIA** The *Rubus ellipticus* and *Myrica esculenta* biomass was investigated for its biosorption capacity for the removal of Pb (II) ions from aqueous solution using batch experiments. pH (2-5), biomass dosage (1-5g) and temp (298-338 K) being the experimental affection the biosorption process were observed. To describe the experimental equilibrium data Langmuir, Freundlich and Temkin models were applied. The biosorption potential of REL and MES for Pb (II) ions was found to be 3.38 mg/g and 7.00 mg/g respectively. The FTIR spectra indicated that the fundamental groups predominentally involved in the biosorption of Pb (II) ions. The calculated thermodynamic parameters (ΔG^0 , ΔH^0 and ΔS^0) showed that the biosorption of Pb (II) ions onto REL and MES was feasible, spontaneous (ΔG^0 <0) and endothermic (ΔH^0 >0) at (298-338 K). It was concluded that MES can be used as an effective low-cost and environmentally friendly biosorbent for the removal of Pb (II) ions from aqueous solution.

Keywards: Biosorption, FTIR, Rubus ellipticus (REL), Myrica esculenta (MES) and Thermodynamics

BIOTECHNOLOGICAL METHODS FOR MULTIPLICATION AND CONSERVATION OF TIMUR SUSHMA TAMTA DIANT. TISSUE, CHI TURE, LABORATORY, DEBARTMENT, OF ROTANY, D.S.R., CAMPUS

PLANT TISSUE CULTURE LABORATORY, DEPARTMENT OF BOTANY, D.S.B. CAMPUS, KUMAUN UNIVERSITY, NAINITAL 263002

India has richest plant based medicinal traditional system because of its rich biodiversity and the pharmaceutical industries are directly or indirectly dependent upon the plant material. Among different medicinal plants of Indian Himalayan region, *Zanthoxylum armatum* DC. (family: Rutaceae) is one of the such plants. Commonly it is known as 'Timur' or 'Toothache tree'. Due to significant medicinal properties and it's continuous increasing demand in pharmaceuticals, *Z.armatum* has been placed in endangered category (IUCN). Efforts could be applied for the conservation and multiplication of this important medicinal plant by using different biotechnological approaches i.e. production of plants by using stem cuttings in *ex vitro* conditions, production of plants by using various explants in *in vitro* conditions with the application and manipulation of different plant growth regulators. Plants thus obtained could further be raised in nursery. Workable regeneration protocols could be transferred to farmers and if needed, training could also be provided to them for their livelihood support. **Key words:** *Zanthoxylum armatum, ex vitro, in vitro*

INTEGRATED NUTRIENT, WEED, DISEASE AND PEST MANAGEMENT RAMARAO¹ AND DESAI, B. K². ¹DEPARTMENT OF AGRONOMY, UAS, RAICHUR ²DIRECTOR OF RESEARCH AND PROFESSOR OF AGRONOMY, UAS, RAICHUR

By 2050 the world's population will reach 9.1 billion, 34 percent higher than today. Nearly all of this population increase will occur in developing countries. Worldwide, about 10,000 species of insects are important as pest, out of 750,000 identified species. Over 50,000 species of fungi are responsible for some 1,500 plant diseases; Over 1,800 species of weeds out of the known 30,000 cause serious economic loss. About 15,000 species of nematodes produce more than 1,500 serious deleterious effects on plants. Over 1, 00,000 species of pests destroy food which could be food for 135 million people. The word pest has no biological meaning. Pests are organisms that diminish the value of resources in which we are interested. In India, crops are affected by over 200 major pests, 100 plant diseases, hundreds of weeds and other pests like nematodes, harmful birds, rodents and the like. About 4,800 million rats cause havoc in India. Approximately, 30 % of Indian crop yield potential is being lost due to faulty nutrient management which in terms of quantity would mean 30 million tons of food grain. The value of total loss has been placed at Rs 50,000 million, represents about 18 % of the gross national agriculture production. An integrated management approach integrates preventive and corrective measures to keep pests, diseases and weeds from causing significant problems, with minimum risk or hazard to humans and desirable components of their environment. Integrated method is a flexible, dynamic strategy, which needs updating periodically as information is received from management practice results. Integrated programs have proven a track record of significantly reducing the risks and related to pesticides, while improving quality, health and welfare of the environment. Minimize the level of chemical use of poisons that has been found harming the soil, water, plant and human as well.

Key words: Nutrient, Weed, Disease, Pest

MANAGEMENT OF ORGANIC WASTES IN MATHURA REGION THROUGH VERMICOMPOSTING RUCHI AGRAWAL* AND NEHA PATHAK DEPARTMENT OF ZOOLOGY, D.S. DEGREE COLLEGE. ALIGARH

Vermitechnology is a Promising technique that has shown its potential in certain challenging areas like waste recycling, management of solid wastes etc. In this present work, we deal with the management and decomposition of organic wastes by using vermicomposting technology to produce nutrient rich worm substance. Two types of livestock manure in combinations with agro/kitchen wastes were used for culturing the earthworm *Eisenia foetida*. The growth and development of an epigeic earthworm *Eisenia foetida* was studied under identical laboratory conditions. Physico-chemical characteristics of two livestock manures, Cow and Buffalo were noted. The concentration

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of total organic carbon and total potassium were higher in Cow manure as compared to Buffalo manure. As a result, the development of *Eisenia foetida* were found higher in combination of Gram bran mix with Cow dung. **Key words.** Organic wastes, Vermitechnology, kitchen waste , Agro-waste , *Eisenia foetida*.

ECONOMICS OF THE RESEARCH ENTITLED WITH "STUDIES ON GROWTH AND YIELD OF SPICES UNDER BAMBOO-BASED AGROFORESTRY SYSTEM"

DHANYASHRI P.V., SARASWATI SAHU, YOGESH KUMAR AGARWAL[,] DR. M. JADEYEGOWDA DEPARTMENT OF SILVICULTURE AND AGROFORESTRY, BIRSA AGRICULTURAL UNIVERSITY, KANKE - 834006, RANCHI

DEPARTMENT OF SILVICULTURE AND AGROFORESTRY, COLLEGE OF FORESTRY, SHUATS, PRAYAGRAJ-211007 DEPARTMENT OF NATURAL RESOURCES AND MANAGEMENT, COLLEGE OF FORESTRY PONNAMPET

The research entitled with "Studies on Growth and Yield of Spices under Bamboo-based Agroforestry System" conducted at farm campus of Ranchi Veterinary College, B.A.U. agroforestry field, Ranchi, Jharkhand to find out their best combination for economic feasibility of bamboo-based agroforestry system in combination of Fennel (*Foeniculum vulgare* Mill.), Coriander (*Coriandrum sativum* L.) and Fenugreek (*Trigonella foenum-graecum* L). The design adopted was RBD with seven treatments and three replications. The treatments were T₁: Bamboo + Fennel, T₂: Bamboo + Coriander, T₃: Bamboo + Fenugreek, T₄: Sole Bamboo T₅: Sole Fennel, T₆: Sole Coriander and T₇: Sole Fenugreek. The maximum net return T₁ Bamboo + Fennel (₹. 1,11,563 ha⁻¹) followed by T₂ (Bamboo + Coriander) (₹. 1,02,938 ha⁻¹), T₃ (Bamboo + Fenugreek) (₹. 89,235 ha⁻¹), T₅ Sole Fennel (₹. 78,296 ha⁻¹), T₆ (Sole Coriander) (₹. 59,136 ha⁻¹), T₇ (Sole Fenugreek) (₹. 51,400 ha⁻¹) and minimum was in the Sole Bamboo (₹. 26,459 ha⁻¹).

Keywords : - Bamboo, Fennel, Coriander, Fenugreek, Economics, B:C Ratio

USE OF ALGAE AS BIOFUEL-A REVIEW CHHAYA SINGH *, NEHA CHAUHAN, SHARMILA, SHIVANI GOVERNMENT DEGREE COLLEGE, THALISAIN, PAURI

The fossil fuel is a source of air pollution, land and water detoriation. The need of time is an alternative which reduce our dependency on fossil fuel which may be biofuel from renewable sources and help to provide healthy global environment and economic sustainability. The term "algae" refers to a large variability of organisms—from small microscopic cyanobacteria to giant kelp—which have the ability to convert sunlight into energy using photosynthesis, like other plants. There are over 100,000 genetically different strains of algae. The different species reported who have good potential for biodiesel are such as Tribonema, Ulothrix and Euglena. Gene technology can help to enhance the production of oil and biodiesel contents and stability of algae. Algae's potential as a renewable fuel source is due to the increase of algal biomass productivity per acre. According to some researchers algae could be 10 or even 100 times more productive than conventional bioenergy crops. The key challenge in real world is achieving high productivity and to realizing the promise of sustainable and economical algal biofuels. Algae can be readily processed into the raw material to make fuels for cars, trucks, trains, and planes after harvesting. There are many advantages of biofuels production from microalgae such as their rapid growth rate, greenhouse gas fixation ability and high production capacity of lipids. The present review article emphasis on the role of algae as a possible ideal biofuel, substitute for fossil which could help to manage the energy crisis.

Key words: Algae, Gene technology, Biofuel

FLOOD AND DROUGHT; COCEPT AND MANAGEMENT

BHAGWAT SARAN¹, ANIL KUMAR²AND SHREYA NIVESH³

DEPARTMENT OF SOIL AND WATER CONSERVATION ENGINEERING, GOVIND BALLABH PANT UNIVERSITY OF AGRICULTURAL AND TECHNOLOGY, PANTNAGAR, INDIA.

Drought and flood both are the most dangerous natural cause to failure the economy of any country. In India,about 42 % of land in 2019 facing the problem of drought, most of the area of drought covered in the state of Rajasthan, Andhra Pradesh, Bihar, Gujarat, Jharkhand, Karnataka, Maharashtra, some parts of the North-East, Tamil Nadu and Telangana. These states are covered about 500 million people; it means 40% of the country's population is affected by the drought. Theyield of agricultural crops is decrease in the drought prone areas. So we think about how can reduce the water requirement of crops or saving of irrigation water, we used micro irrigation (Drip and Sprinkler) for crop production in drought prone area because it requires less amount of water to growing crops. When the rainfall is above the normal value, the problem of flood will occur. In the year 2019, India receives the heaviest rainfall over the last 25 years. Due to this excess rainfall, at least 1600 peoples are died and millions of people were displaced between June and October 2019. More than 13 states are affected by flood in late June and early October- 2019.Maharashtra, Bihar, Madhya Pradesh and Karnataka were the most severely flood affected states.So we think about how to control or minimise the losses of flood, Vegetation can help to slow the runoff and increase the infiltration and prevent flooding.

Keywords: Drought, Flood, Crops and Vegetation.

FACTORS INFLUENCING BUYING OF SHG PRODUCED FOOD AND NON FOOD ITEMS – A STUDY IN PURI DISTRICT OF ODISHA

PRITISHRI PARHI¹, MISS MONALISHA SAHOO², DR. (MRS.) TRUPTI MOHANTY³, MANASHI MOHANTY⁴ ¹DEPARTMENT OF HUMAN DEVELOPMENT & FAMILY STUDIES, OUAT, BBSR ² POST-GRADUATE STUDENT, FAMILY RESOURCE MANAGEMENT, OUAT, BBSR ³DEPARTMENT OF FAMILY RESOURCE MANAGEMENT, OUAT, BBSR ⁴DEPARTMENT OF FAMILY RESOURCE MANAGEMENT, OUAT, BBSR

Home makers /house wives of Indian subcontinent play a significant role in purchasing items for food preparation and other items of home makings. Purchasing right items with good quality, adequate quantity and of course in right time is associated with various considerations which Indian ladies make while they are in the role of housewives or home maker. In an attempt to identify the various factors associated

with such buying behavior, a study was undertaken in Puri district covering about 120 no. of respondents housewives selected randomly from Pipili and Nimapara blocks. Statistical analysis of the data with the help of parametric statistics was done to draw appropriate conclusions. The findings of the study revealed that reasonable and affordable price of the product followed by use of quality raw materials were considered mostly by majority of the respondents to the tune of 54.16% and 53.6% respectively while purchasing food and non-food item marketed by Self Help Group of the study areas. It is also followed with factors like nutritious character, handmade, proper labeling, easy availability, non-reactive packaging material, name of the product and non-adulteration and ambience of the products in the rank order of III, IV, V, VI, VII, VIII , IX and X respectively. Similarly the major considerations for non-food items are reasonable and affordable price, ambience of the products, products quality, and packaging materials, homemade character are in the rank of I, II, III, IV& V respectively as agreed by majority of the respondents.

Key words: SHG groups, Food Security, Buying behaviour

FRUIT AND VEGETABLE INDUSTRIAL WASTE: AN EXCEPTIONAL SOURCE OF BIOACTIVE COMPONENTS

SUMAIRA JAN*, KRISHAN KUMAR AND NASEER AHMAD

DEPARTMENT OF FOOD TECHNOLOGY, AKAL COLLEGE OF AGRICULTURE, ETERNAL UNIVERSITY, BARU SAHIB, SIRMOUR, HP-173101

Fruits and vegetables are a substantial section of food sector and create large amount of wastes annually. Waste generated from fruit and vegetable processing industry is an exceptional source of valuable bioactive components such as carotenoids, minerals, anti-oxidants, polyphenols etc. These bioactive compounds exert potential health benefits due to their anti-cancer, antioxidant, anti-allergenic, anti-atherogenic and anti-inflammatory properties. Different secondary metabolites, minerals and vitamins have been extracted from food wastes, using various extraction methods. Polyphenols are main micronutrient components in our diet, and there are various evidences for their importance in the prevention of various lifestyle diseases. Dietary polyphenols possess an abundant diversity in structures, ranging from simple molecules to polymers. Tannins are polyphenols having high-molecular-weight structures and are known to have distinct potential to interact with proteins. The commonly used techniques for the extraction of these valuable components include solvent extraction, super-critical fluid extraction, sub-critical water extraction. These techniques can prove to be an innovative approach in next few years to enhance the production of specific bioactive compounds to be used as nutraceutical or as an ingredient in the development of functional foods.

Key words: Fruit and vegetable wastes, bioactive components, extraction techniques, health benefits

PEARL MILLET: NUTRITIONAL POTENTIAL, HEALTH BENEFITS AND PROCESSING ASPECTS

QURAT-UL-EAIN HYDER RIZVI*, KRISHAN KUMAR AND NASEER AHMAD DEPARTMENT OF FOOD TECHNOLOGY, AKAL COLLEGE OF AGRICULTURE, ETERNAL UNIVERSITY, BARU SAHIB, SIRMOUR, HP-173101

Underutilized grains like millets play a major role in food security of millions of people. Pearl millet is a rich source of nutrients as it contains a large quantity of phytochemicals which act as nutraceutical components. In millets, phenolic compounds are found in the insoluble as well as soluble bound forms, which provide beneficial health effects other than the basic nutrients such as fats, carbohydrates, proteins, vitamins and minerals especially iron. Further, phenolic components in millet grain are bio-accessible, having bioactivities against numerous patho-physiological circumstances and serves as potential natural sources of antioxidants in biological systems and food. These grains are naturally gluten-free, an advantage considering that the intake of gluten protein, particularly found in wheat, may promote several metabolic disorders in certain individuals causing intolerances, allergies, intestinal permeability and autoimmune diseases. It has less starch, high energy, high fiber (1.2g/100g, most of which is insoluble) and α -amylase activity 8-15 times higher than wheat, low glycemic index and is gluten free. It is also rich in protein content which ranges from 8 to 19% and it is low in tryptophan, lysine, threonine and the sulfur-containing amino acids. Pearl millet has wide application in preparation of wide variety of traditional foods, such as flatbreads, couscous, porridges, sweets and fermented beverages. Due to presence of many nutritional and bioactive components, it has great potential to be utilized in preparation of different nutraceutical bakery products, infant formulas, fermented beverages etc. which can be helpful in improving the nutritional status of society as well as the promotion of this underutilized grain.

Key words: Pearl millet, bioactive compounds, gluten free, nutritional value, nutraceutical potential

TO STUDY THE PHYSICO CHEMICAL AND STORAGE STABILITY OF DEHYDRATED TOMATO POWDER VISHAL KUMAR

SARDAR VALLABHBHAI PATEL UNIVERSITY OF AGRICULTURE & TECHNOLOGY, MEERUT (UP)

Tomato powder has good potential as substitute of tomato paste, soup, puree and other tomato products. In order to protect physicochemical properties and nutritional quality of tomato during dehydration process, investigation was carried out using different drying methods and pretreatments. Results show that pre-treatment with KMS and sodium benzoate increased water removal and moisture mobility in tomato slices (4mm, 6mm and 8mm thickness) during drying process. Storage studies in LDPE pouch and aluminum foil pouch showed less change in the quality of food products. The lycopene content did not decrease more than 20% as compared to the control sample and provide extension of shelf life in acceptable condition four months. In most of the quality characteristics cabinet tray dryer samples presented better values in comparison to green house type solar, foam mat drying but freeze drying sample was good than compare to other drying methods. The tomato slices thickness (4mm, 6mm and 8mm) were dried under cabinet tray dryer at 65 0 C, green house type solar dryer, foam mat drying at 65 0 C and freeze drying methods. Tomato is highly perishable food. The result expressed was initial moisture content 1076.47 on dry basis of every thickness of tomato slices treated and untreated because initial weight 900 g of all samples before drying. The lowest final moisture content was found 0.510 on dry basis under cabinet tray dryer at 65 0 C. The acidity and microbial growth was increased , the highest value were found 7.93 of untreated samples (8mm) in aluminum foil pouch and same as 4.55×10^{5} of untreated samples (6mm). Determine was minimum final value of pH, lycopene and ascorbic acid (vitamin-c) was 2.05 untreated of 6 mm

sample in LDPE pouch, 50.71 untreated of 6 mm sample in LDPE pouch and 8.50 untreated of 4 mm sample in aluminum foil pouch. The main reason of ascorbic acid degradation, during storage periods might be due to oxidation or irreversible conversion of L-ascorbic acid in to dehydration process ascorbic acid in the presence of enzyme ascorbic acid oxidase (ascorbinase) caused by trapped or residual oxygen in the storage conditions. Lactic acid bacteria found in egg albumen could produce a large number of lactic acid as end product of carbohydrate metabolism. Browning reactions change sensory attributes during storage periods. There are two important forms of browning, enzymatic and non-enzymatic (Maillard reactions, caramelization, ascorbic acid oxidation). All value found significant at (P> 0.5%) with the help of ANOVA. The main causes of tomato lycopene degradation during processing and storage are isomerisation and oxidation. Lycopene content in dehydrated tomato powder was influenced by drying methods, pre-drying treatments and storage condition including packaging material during storage period. The superior quality found of the freeze dryer samples and second is cabinet tray dryer samples.

EFFECT OF MACRO, SECONDARY PLANT AND MICRO NUTRIENTS IN SITE SPECIFIC NUTRIENT MANAGEMENT EXPERIMENT UNDER RICE–WHEAT SYSTEM

ASHISH KUMAR MANNADE, ANURAG AND KANCHAN BHANDULKAR

INDIRA GANDHI KRISHI VISHWAVIDYALAYA, COLLAGE OF AGRICULTURE, RAIPUR, CHHATTISGARH

Rice-wheat is the most predominant cropping system in the Chhattisgarh state and the productivity of these crops was very low during early sixties in the last century. The production of rice and wheat has increased considerably since then due to increase in areas under rice-wheat system, Soil samples were collected during 2016-17 from a field trial conducted at Indira Gandhi Agricultural University, Raipur to investigate the status of macro, micro and secondary plant nutrients in rice-wheat system under nutrient management technique. In the nutrient exhaustive rice-wheat system, the results of our study revealed that there was no significant change in per cent organic carbon content (% OC) due to the treatment effect over its initial status (0.38%). On the other hand there was slight improvement in N status in all the treatment combinations and maximum value of N was recorded in T₁₁ treatment (153.4 kg ha-1). Further there was slight improvement in P status in all the treatments from its initial value of 28.7 kg ha⁻¹ except T₁₂ (27.0-31.9 kg ha-1). The Zn, Cu, Fe, Mn, B and S levels in all the fourteen treatments ranged from 1.21-3.50, 0.82-3.17, 31.7-49.6, 3.52-6.12, 1.02-1.15 and 0.87-1.20 mg kg⁻¹ respectively. The increase in available Zn, Cu, Fe, Mn, B and S in soil was recorded in the treatment was attributed to creation of reduced environment during rice crop growth. The results of our study indicated that higher fertility status of soil could be maintained through macro and micro and secondary nutrients application.

Keywords: Macro and micronutrients, rice-wheat cropping system.

OPTIMIZATION OF NITROGEN DOSE FOR BETTER GROWTH AND YIELD MAXIMIZATION OF IGKVR-1(RAJESHWARI)

ASHISH KUMAR MANNADE, ANURAG AND KANCHAN BHANDULKAR

DEPARTMENT OF SOIL SCIENCE AND AGRICULTURAL CHEMISTRY, INDIRA GANDHI KRISHI VISHWAVIDYALAYA, COLLAGE OF AGRICULTURE, RAIPUR, CHHATTISGARH

An experiment was conducted at Soil Science Field Laboratory of Indira Gandhi Agricultural University, Raipur during aman season of 2016 to determine the optimum dose of nitrogen on growth and yield of Rajeshwari. The soil was silt loam having pH 6.24, organic matter 3.31%, total N 0.179, available P 12.76 ppm, exchangeable K 0.13 me 100 g⁻¹ soil and available S 10.47ppm. The experiment was laid out in a Randomized Complete Block Design (RCBD). There were seven treatments with three replications. Recommended dose of fertilizers @ P 50 kg ha⁻¹, K 35 kg ha⁻¹ and S 10 kg ha⁻¹ were applied as basal dose from TSP, MOP and gypsum respectively and N from urea was applied as per treatments. The treatments used in the experiment were T1: control, T2: PKSN0, T3: PKSN50, T4: PKSN60, T5: PKSN70, T6: PKSN80 and T7: PKSN90. Urea was applied in three equal splits. The crop was harvested at full maturity. All yield contributing characters like plant height, effective tillers hill⁻¹, panicle length, filled grains panicle⁻¹ and grain and straw yields except 1000- grain weight of Rajeshwari significantly responded to different levels of applied N and varied from 81.50 to 89.55 cm, 7 to 11, 20.67 to 22.44 cm, 104 to 142, 3.75 to 6.17 t ha⁻¹ and 4.52 to 7.50 t ha⁻¹, respectively. The highest grain yield of 6.17 t ha⁻¹ was recorded in the treatment T7 (90 kg N ha⁻¹). The highest straw yield of 7.50 t ha⁻¹ was also noted in the treatment T7 (90 kg N ha⁻¹). The grain and straw yields due to the different treatments increased by 20 to 64.53% and 21.02 to 65.93% respectively over control. The N content and uptake by grain and straw were significantly influenced by the application of different levels of N. The results indicated that the use of 90 kg N ha⁻¹ had better performance on the grain and straw yields. Therefore, the application of 90 kg N ha⁻¹ for Rajeshwari cultivation is the best option for higher yield at IGKV, Raipur.

Keywords: Rice, nitrogen, site specific nutrient management, yield

DOUBLING THE FARMERS INCOME THROUGH INNOVATIVE APPROACH

RAUSHAN KUMAR , ANAMIKA KUMARI AND RAJNI KUMARI

DEPARTMENT OF HORTICULTURE, BIHAR AGRICULTURAL UNIVERSITY, SABOUR, BHAGALPUR

Sixty percent of India's population lives in rural areas and nearly 54% of India's workforce engages in agriculture and its allied activities. As our country is Agrarian driven economy and its contribution to India's GDP is merely 18%. The GOI has committed to double farmer income by 2022. Our past strategies were primarily focused on increasing agricultural output and improving food security that resulted in low income of farmers and farmer's income also low in compare to income of those working in the non-farm sector,. Therefore, there is need to double farmer's income to safeguard the farmer's life, to reduce agrarian distress and to bring parity between income of farmers and those working in non-farm sectors. The real issue is not the level of production but how produce can be converted into value that decides farmer's income. For the above purpose fulfilled, following are the innovative approaches ,must be implemented in comprehensive manner. Increasing production through productivity by offering better access of irrigation facilities, quality seed and technological advancement, Resource use efficiency or saving in cost of production through optimal application of chemical fertiliser based on soil health card and use of NCU will save the cost and enhance the availability of Nitrogen to crop and use of micro irrigation help in reducing water waste and enhances yield , Increasing cropping intensity by raising the short duration crops after the main Kharif or Rabi season so that agricultural land does not remain unused for half of the productive period. Diversification from cereals to high value crops fruits , vegetables , flowers, medicinal, condiments and spices. Improvement in livestock productivity by enhancing production and productivity of

cows. Allied activities should be also promoted like tree plantation, beekeeping, fishery, goat, sheep and poultry. Ensuring better prices of produces through MSP and removing middle man. There is need to encourage private sector in agricultural R&D to invest in food processing,warehouses, cold storages, contract farming and marketing and in this way certainly farmer's income will be doubled in stipulated period of time.

Keywords-doubling, income, farmers, technology, approach

EVALUATION OF BOTTLE GOURD (*LAGENARIA SICERARIA*) TO GROWTH AND YIELD KALPANA KUNJAM¹, MEGHCHAND DEWANGAN² AND INDU SOM³ 1,3,DEPARTMENT OF VEGETABLE SCIENCE,2 DEPARTMENT OF PLANT PATHOLOGY COLLEGE OF AGRICULTURE RAIPUR, INDIRA GANDHI AGRICULTURE UNIVERSITY, RAIPUR, CHHATTISGARH-492012, INDIA.

Bottle gourd (Lagenaria siceraria L.) belongs to the family Cucurbitaceae, is an important and popular vegetable in India. Bottle gourd or white flowered gourd is commonly known as Lauki, it is a monoecious, diploid, climbing or prostrate plant, solitary flowers and strictly cross pollinated due to its monoceious nature. Chhattisgarh is also known for its biodiversity particularly in Bastar plateau and it is hot spot for the crop. The experiment was comprised of nine genotypes of bottle gourd and laid out in Randomized Block Design (RBD) with three replications. The main objective of mentioned is to find out the growth, yield and quantitative parameters of bottle gourd genotypes, to work out parameters of variability for fruit yield and its component characters in bottle gourd and to study the association (correlation and path coefficient) for fruit yield and its component characters. Result revealed that the genotype 2016/B06VAR-8 performed better than other genotype by evaluating various characters it was superior on other genotype from its fruits yield, number of fruit per plant, number of branches, fruit girth and days to first fruit harvest. This analysis of variance revealed that mean sum of squares due to genotypes was highly significant for all characters except for number of fruit per plant and average weight per fruit. Estimation of genetic parameters for various characters revealed that the highest magnitude of genotypic and phenotypic coefficient variation were recorded for node number at first male flower, average weight per fruit, fruit length and node number at first female flower. The node number at first male flower, fruit length and average fruit weight showed high heritability coupled with high genetic advance. Correlation analysis revealed that fruit yield showed the high positive and significant correlation with days to first male flower, fruit girth at both genotypic and phenotypic level, vine length, number of fruit per plant, average fruit weight and duration of crop at genotypic level only. The path analysis revealed that positive direct effect of fruit yield on average fruit weight, node number at first female flower, days to first female flower, node number at first male flower, first fruit harvest and fruit girt. Fruit length, days to first male flower, number of branch, days to 50 % flowering, duration of crop, number of fruit per plant and fruit length showed negative direct effects on fruit yield. These analyses may help in obtaining higher fruit yield with growth and fruit characters of lead components in bottle gourd for Chhattisgarh plains. It may lead to development of varieties through crop improvement programme.

ECO-FRIENDLY MANAGEMENT OF DISEASE COMPLEX CAUSED BY ROOT-KNOT NEMATODE AND FUSARIUM WILT FUNGUS USING PGPR, *PAENIBACILLUS* SPP.

ZAKAULLAH KHAN, BHARAT H. GAWADE AND S.C. DUBEY

ICAR-NATIONAL BUREAU OF PLANT GENETIC RESOURCES, PUSA CAMPUS, NEW DELHI- 110012

Root-knot nematodes (RKN), *Meloidogyne* spp. are sedentary endoparasites of roots, attacking a wide range of crops worldwide. Infection of roots by RKN predisposes plants to infection by soil-borne root-infecting fungi resulting in the development of disease complex. The RKN, *Meloidogyne incognita*, becomes a part of an etiological complex, often resulting in combined pathogenic potential to be far greater than the sum of damage that either of pathogens can produce individually. The synergistic effect of *M. incognita* was confirmed in fusarium wilts of tomato caused by *Fusaium oxysporum* f. sp. *lycopersici* by comparing disease severity (wilting and plant death) between single and concomitant inoculation of nematode and fungal pathogens. Using plant growth-promoting rhizobacteria (PGPR) *Paenibacillus polymyxa* and *P. lentimorbus* strains, *in vitro* and *in vivo* experiments were conducted for the biological control the disease complex. In *in vitro* experiments, among 40 tested strains of *Paenibacillus*, *P. polymyxa* GBR508, GBR462 and *P. lentimorbus* GBR158 showed the strongest antifungal and nematicidal activities against *F. oxysporum* f. sp. *lycopersici* and *M. incognita*, respectively. When these three strains used in pots as drench treatment at the rate of 5ml (10⁸CFU/ml)/plant, significantly reduced penetration of *M. incognita* juveniles (J2) into tomato roots, inhibited giant cell formation, reduced the symptom development of the disease complex (wilting and plant death), and increased plant growth significantly. The control effects were estimated to be 90–98%, and also reduced root gall formation by 64–88% compared to the untreated control. The experiments also revealed that *Paenibacillus* strains induced systemic resistance against *M. incognita*.

STUDIES ON CROP DEPREDATION CAUSED BY WILD ANIMALS IN SOME VILLAGES OF CHENAB VALLEY JAMMU AND KASHMIR INDIA

KULBHUSHAN KUMAR* AND SATPAL SINGH BISHT

DEPARTMENT OF ZOOLOGY, D.S.B. CAMPUS KUMAUN UNIVERSITY, NAINITAL UTTARAKHAND-263002

In India about 65% of the people are directly or indirectly dependant on agricultural sector for economic survival. The annual income of farmers is significantly influenced by the yield of the crops which is affected by wild animals. However, the particular attention should be paid to the depredation caused by wild animals. Crop depredation by wildlife is mostly frequent in the Chenab valley. Understanding of crop depredation factors is crucial to the development of effective management strategies. The frequency of damage events mostly observed in fields and also after harvesting of crops. Farmers use number of traditional and conventional techniques to protect their crops from wild animals. Crop raiding represents a major threat to the survival of farmers and significantly increase in the rate of frequency of crop raiding. Habitat degradation and destruction of the wild animals need to be monitored and addressed. This result in the decline of number of wild animals and therefore management strategies should target biodiversity conservation without impeding socioeconomic condition of the people. The aim of study is to provide a general description of agricultural damage caused by wild animals in the study site.

Key words: Economic survival, Crop raiding, biodiversity conservation

CHALLENGES BEFORE INDIAN AGRICULTURE

ROHIT KUMAR¹, SANJEEV³, RAJIT³, SHASHWAT KUMAR³, ANIL KUMAR³, NIVEDITA KAPOOR³ AND DEEPAK KUMARI³

UNIVERSITY INSTITUTE OF AGRICULTURE SCIENCE, CHANDIGARH UNIVERSITY, CHANDIGARH

Increasing population and income have changed the demand for food with a substantial increase in demand for fruits/vegetables and livestock and quality products. In addition, concern for environment protection and globalisation has put tremendous pressure on Indian agriculture. In fact, increasing demand for water the industry and household sectors, shrinking agricultural land due to urbanization, and consequent rising energy demand in agriculture sector are likely to be the binding constraints in future. The major challenges before Indian agriculture are its marginal land holdings, widening production disparities between irrigated and rainfed areas (ratio of irrigated to rainfed yield range from 1.25 to 3.30), degradation and depletion of natural resource base, climate change, increase in non-agricultural demand for land and water, inadequate mechanization, labour shortage, inefficient use of inputs, wastage of agricultural produce due to inadequate post-harvest operations, lack of awareness among farmers for modern crop production methods, ineffective extension services, inefficient financial resources for investments, high levels of consumption services (such as subsidies) resulting in wastages and above all low percapita income for farmers. These challenges have to be addressed through improved technologies; without compromising the sustainability of our natural resource base. The specific areas of concern needing priority attention are as follows: 1) Increasing productivity of agricultural production system per unit of land, water, energy and other critical inputs. 2) Diversification of the farm production systems with better storage and processing technologies for domestic food & nutritional security and increased export of farm produce/product. 3) Sustainable management and equitable use of natural resources such as land, water and biodiversity, especially in the context of changing climate. 4) Bio-security and crop health management for higher yields and improved food quality. 5) Enhanced profitability, generating non-farm employment, rural livelihood, gender mainstreaming and global competitiveness in agriculture through appropriate technology development, market linkage and policy. 6) Accelerated information and technology flow to farmers and other stakeholders through efficient extension approaches. 7) Quality human resource development in frontier areas of science and management of agricultural programs and enterprises

Keyword; Agricultural, Globalization, Nutritional, Profitability and Climate

COMPARATIVE PERFORMANCE OF DIFFERENT SHADING MATERIAL FOR PRODUCTION OF HEALTHY VEGETABLE SEEDLINGS UNDER KONKAN CONDITIONS

<u>O. A. NIRMAL</u>, P. C. HALDAVNEKAR, Y. R. PARULEKAR, C. D. PAWAR, M. C. KASTURE AND A. V. BHUWAD DEPARTMENT OF HORTICULTURE, COLLEGE OF HORTICULTURE, DAPOLI, DISTRICT - RATNAGIRI

Konkan is a high rainfall area situated at west coast of Konkan region. Various vegetable crops viz. chilli, brinjal, tomato etc. are popularly grown during *rabi* season after rice. Use of healthy seedling is key for enhanced production under open condition, due to October heat and intermittent rains the poor quality seedlings are produced. Hence, with view to produce healthy seedling by using various low cost shading material the present investigation was carried out during *rabi-summer* 2015-16 to find out optimum shade intensity for raising healthy vegetable seedlings during, rabi-summer season. Field experiment was conducted in Randomized Block Design; consisting of seven treatment namely T_1 : 'U' shaped tunnel covered with shade net 25 per cent, T_2 : 'U' shaped tunnel covered with shade net 50 per cent, T_3 : 'U' shaped tunnel covered with shade net 75 per cent, T_4 : 'U' shaped tunnel covered with low density polyethylene paper, T_5 : 'U' shaped tunnel covered with coarse and loosely woven jute bag and T_7 : Control which were replicated thrice. It was observed that, all the parameters under study were varied significantly in different treatments. Various growth parameters like plant height, Number of leaves, girth at collar region were superior in seedling production in T_6 . The lowest atmospheric and soil temperature was noticed in the treatment T_6 followed by T_5 . Maximum increase in the atmospheric humidity in the treatment T_3 over control and it was followed by T_5 . Thus, 'U' shaped tunnel covered with coarse and loosely woven jute bag can be used for production of healthy vegetable seedlings.

Key words: - Chilli, brinjal, healthy seedlings, shade intensities.

MALEIC HYDRAZIDE INDUCED VARIABILITY IN FENUGREEK (TRIGONELLA FOENUM-GRAECUM L.) CULTIVARS CO1 AND RMT-1

NAZARUL HASAN

DEPARTMENT OF BOTANY, MUTATIONAL BREEDING LABORATORY, ALIGARH MUSLIM UNIVERSITY, ALIGARH, 202002, UP., INDIA

Trigonella foenum graecum (fenugreek), a leguminous annual herb with tremendous medicinal and therapeutic importance. Pre-soaked seeds were treated with different concentrations- 0.01, 0.02, 0.03, 0.04, 0.05, 0.06, 0.07, 0.08, 0.09 and 0.10% of maleic hydrazide for 6 hours duration each. The mutagen treatments shifted the mean values of all quantitative and bio-physiological traits in positive as well as negative direction as compared to control. The total chlorophyll content in both the cultivars showed a considerable negative shift from their control at all the treatment conditions. Seed germination, pollen fertility and plant survival reduced in a progressive manner with the increasing mutagen. The treatments were found to be appropriate for breeding objectives focused on productivity, considering the lower biological damages with a higher percent of the variance in quantitative traits. A considerable increase in variance was recorded for all the traits studied including morphological traits. The novel morphological mutations induced in the present study would also be useful in botanical studies of fenugreek. The present experimentation reflected that the induced variation with 0.06% could be applied for the generation of new cultivars of fenugreek. The mutation breeding approach could be used in fenugreek to develop cultivars with improved seed yield, early seed maturity, better seed quality and determinate growth habit.

A REVIEW ON -: ALZHEIMER'S DISEASE

SHABANA ZAFFAR, ARPITA JAISWAL, CHANDRA PRAKASH, ASHISH KUMAR PATHAK, SONU SHARMA STUDENT OF SCHOOL OF PHARMACEUTICAL SCIENCE, JAIPUR NATIONAL UNIVERSITY, JAGATPURA, JAIPUR

The most common type of dementia. A progressive disease beginning with mild memory loss possibly leading to loss of the ability to carry on a conversation and respond to the environment. Involves parts of the brain that control thought, memory, and language. It Can seriously affect a person's ability to carry out daily activities. Age is the best known risk factor for Alzheimer's disease. Family history—Genetics may play a role in developing Alzheimer's disease. Changes in the brain can begin years before the first symptoms appear.Memory loss that disrupts daily life, such as getting lost in a familiar place. Trouble handling money and paying bills. Difficulty completing familiar tasks at home, at work or at leisure. Decreased or poor judgment. Changes in mood, personality, or behavioral. Medical management can improve the quality of life for individuals living with Alzheimer's disease and their caregivers. There is currently no known cure for Alzheimer's disease. Treatment addresses several different areas. Helping people maintain mental function, managing behavioral symptoms, Slowing or delaying the symptoms of the disease.

Key words: Alzheimer's, Dementia, Leisure, Behavioral

A REVIEW ON LEUKEMIA: BLOOD CANCER

ARPITA JAISWAL, SHABANA ZAFFAR, ASHISH KUMAR PATHAK, DR SONU SHARMA STUDENT OF SCHOOL OF PHARMACEUTICAL SCIENCES, JAIPUR NATIONAL UNIVERSITY, JAIPUR

Leukemia is a cancer of the blood or bone marrow. Bone marrow produces blood cells. Leukemia can develop due to a problem with blood cell production. It usually affects the leukocytes, or white blood cells. Leukemia develops when the DNA of developing blood cells, mainly white cells, incurs damage. This causes the blood cells to grow and divide uncontrollably. Healthy blood cells die, and new cells replace them. These develop in the bone marrow. The abnormal blood cells do not die at a natural point in their life cycle. Instead, they build up and occupy more space. As the bone marrow produces more cancer cells, they begin to overcrowd the blood, preventing the healthy white blood cells from growing and functioning normally.

The four most common types of leukemia are acute lymphocytic leukemia, chronic lymphocytic leukemia, acute myeloid leukemia, and chronic myeloid leukemia. Other symptoms may include: nausea, fever, chills, night sweats, flu-like symptoms, weight loss, bone pain, tiredness.Types of treatment include: Watchful waiting, Chemotherapy, Tar Stem cell transplantationgeted therapy, Interferon therapy, Radiation therapy, Surgery.

Keyword - Leukemia, Myeloid, Chemotherapy, Radiation, Interferon

REVIEW ON NANOMEDICINE FOR TREATMENT OF CANCER

ANISH MENON, CHANDRA PRAKASH, ARPITA JAISWAL, SINGH ANKUR, DR SONU SHARMA STUDENTS OF SCHOOL OF PHARMACEUTICAL SCIENCES JAIPUR NATIONAL UNIVERSITY JAIPUR. 302017

Introduction: Nano technology is the industrial and developed resources at the atomic and molecular level. Nano technology discusses to structures unevenly in the 1-100nm size command in at least one dimension. The modernization of Nano medicine results an unmatched chance to progress the dealing of a different types of diseases containing cancer. The unique properties of NPs such as large surface to volume ratio, small size, the ability to summarize different types of drugs, and tunable surface chemistry gives those many benefits over their wholesale counterparts. Cancer is mostly a type of condition clear by reckless production of cell which have possible to affect with different systems of body like digestive, central nervous and circulatory system by settling hormones. There are different types of cancer such as breast, liver, colorectal, prostate, head and neck carcinoma, blood, bladder. The path to the commercialization of Nano drugs may contribute to the success of the cancer drug Cancer is harmful disease, particularly mutable in its presentation, expansion and outcome. Cancer is a multifactorial disease instigated by a composite mixture of heritable and eco-friendly factors. Therefore, the knowledge of cancer can provide new targets and methods for cancer treatment. Nano technology suggestions a fortune of tools.

Classes of Nano drugs used to treat cancer: 1) Lipid-based nanoparticles (liposomes),2) Polymer-based nanoparticles and micelles, 3) Dendrimers, 4) Carbon-based nanoparticles, 5) Metallic and magnetic nanoparticles

Mechanism of action of Nano medicine: In case of active targeting, nanoparticles containing the chemotherapeutic agents are designed in such a way as they directly interact with the defected cells.Nanoparticles can also target cancer through passive targeting. As apoptosis is stopped in cancerous cells, they continue sucking nutritious agents.There is a variety of nanocarriers such as liposomes, dendrimers, micelles, carbon nanotubes, where Therapeutic agents can be entrapped.

Keywords: Targeted delivery NPs, cancer treatment, Nano-medicine, chemotherapy

A REVIEW ON: ZIKA VIRUS

ASHISH KUMAR PATHAK, CHANDRA PRAKASH , ARPITA JAISWAL, SHABANA ZAFFAR , DR SONU SHARMA SCHOOL OF PHARMACEUTICAL SCIENCE, JAIPUR NATIONAL UNIVERSITY, JAIPUR, PIN-302017

Zika is spread mostly by the bite of an infected Aedes species mosquito. These mosquitoes bite during the day and night. Zika can be passed from a pregnant woman to her fetus. There is no vaccine or medicine for Zika. Zika transmission: Through mosquito bites : Zika virus is transmitted to people primarily through the bite of an infected Aedes species mosquito. These mosquitoes typically lay eggs in or near standing water in things like buckets, bowls, etc. Mosquitoes that spread chikungunya, dengue, and Zika bite during the day and night. A mosquito gets infected with a virus when it bites an infected person during the period of time when the virus can be found in the person's blood. Through sex: Zika can be passed through sex. It can be passed from a person with Zika before their symptoms start, while they have symptoms and after their symptoms end, the virus may also be passed by a person who carries the virus but never develops symptoms. The most common symptoms of Zika are -: Fever, Rash, Headache , Joint pain, Muscle pain. **Sexual transmission and testing** : A blood or urine test can help determine if you have Zika from sexual transmission; however, testing blood, semen, vaginal fluids, or urine is not

recommended to determine how likely a person is to pass Zika virus through sex. There is no specific medicine or vaccine for Zika virus. Treat the symptoms. Drink fluids to prevent dehydration. Take medicine such as acetaminophen to reduce fever and pain .Do not take aspirin and other non-steroidal anti-inflammatory drugs.

Keywords: Zika, Zikabite, Transmission, Acetaminophen

AN OVERVIEW OF PHYTOSOMES: AN ADVANCED HERBAL DRUG DELIVERY SYSTEM AND HIGHLY **BIOAVAILABLE PLANT EXTRACTS**

KARISMA SHARMA¹, DR. KARNI SINGH SHEKAWAT, DR. SONU SHARMA² SCHOOL OF PHARMACEUTICAL SCIENCES, JAIPUR NATIONAL UNIVERSITY, JAIPUR SRI BALAJI COLLEGE OF PHARMACY, BENAD ROAD, MACHEDA, JAIPUR

During the last few decades, much work has been directed towards the development of delivery systems. In recent time this phenomenon is also applied to Phytopharmaceuticals. Phytosomes are recently introduced herbal formulations that are better absorbed, and as a result produce better bioavailability and actions than the conventional phytomolecules or botanical extracts. Phytosomes are produced by a process whereby the standardized plant extract or its constituents are bound to phospholipids, mainly phosphatidylcholine producing a lipid compatible molecular complex. This phyto-phospholipid complex, phytosome resembles a little cell. The term "phyto" means plant while "some" means cell-like.Phytosomes exhibit better pharmacokinetic and pharmacodynamic profile than conventional herbal extracts. The phytosome technology has been effectively enhanced the bioavailability of many popular herbal extracts including milk thistle, Ginkgo biloba, grape seed, green tea, hawthorn, ginseng etc and can be developed for various therapeutic uses or as dietary supplements.. Most of the phytoconstituents are water soluble and possess multiple ring structure which leads to poor absorption in human body. These phytoconstituents can be associated with lipid-moieties to absorb better in lipophilic environment known as 'Phytosomes'.Clinical trials of Phytosomes have shown increase in bio-availability of herbal extracts to maximize the amount of the herb's active ingredients utilized by the human body. A standardized extract from Silybum marianum (milk thistle) is an excellent liver protectant but very poorly absorbed. Pharmacokinetic and clinical studies prove that the phytosome complex of milk thistle (called SILIPHOS) is far better absorbed, as well as safe and effective in subjects with impairment of liver function that ranges from mild to severe. Key words - Bio-Availability, Phyto-Constituents, Lipo-Philic, Pharmacokinetic, Compatible,

EFFECT OF FOLIAR APPLICATION OF GROWTH RETARDANTS FOR INDUCTION OF FLOWERING UNDER CLIMATIC FLUCTUATIONS IN MANGO CV. ALPHONSO

A. P. JADHAV, P. M. HALDANKAR, Y. R. PARULEKR, B. R. SALVI, M. M. BURONDKAR, S. B. THORAT, A. V. BHUWAD AND O. A. NIRMAL

DEPARTMENT OF HORTICULTURE, COLLEGE OF HORTICULTURE

DR. BALASAHEB SAWANT KONKAN KRISHI VIDYAPEETH, DAPOLI-415 712, MAHARASHTRA

Konkan region of Maharashtra is known for best quality mango of cv. Alphonso production which is well known for its quality and highest quantity in mango export from India. The performance of Alphonso is influenced by climatic fluctuations which are quite frequent in this region. The delayed rain results in vegetative flush instead of flowering in the month of November-December. The delay in flowering results in late harvesting of fruits in the season which fetches low price in market causing considerable economic loss to mango growers. An attempt was made to hasten the maturity of this post monsoon vegetative flush by foliar application of growth retardants Viz., Cycocel and paclobutrazol, so as to induce flowering at appropriate time in mango. The experiment was conducted at Department of Horticulture, College of Agriculture, Dr. BSKKV, Dapoli (MS), India, in Randomized Block Design with seven treatments of different concentrations of PGR's viz., T1 (CCC @ 1500 ppm), T2 (CCC @ 2500 ppm), T3 (CCC @ 3500 ppm), T4 (PBZ @ 500 ppm), T5 (PBZ @ 1000 ppm), T6 (PBZ @ 2000 ppm), T₇ (Control) which were replicated three times. The foliar application of Paclobutrazol @ 1000 ppm (T₅) recorded induction of flowering by two weeks as compared to control. The treatment also registerd maximum flowering intensity, higher hermaphrodite flowers percentage, fruit set and fruit retention panicle⁻¹, early harvest along with high fruit yield and maximum B:C ratio. Keywords: Mango, Alphonso, paclobutrazol, cycocel, flowering, fruit set, yield.

EFFECT OF CHEMICAL PROCESSING ON WHITENESS INDEX OF SESBANIA ACULEATA (DHAINCHA) FIBRES POOJA BHATT AND ANITA RANI

DEPARTMENT OF CLOTHING AND TEXTILES, COLLEGE OF HOME SCIENCE, G. B. PANT UNIVERSITY OF AGRICULTURE AND TECHNOLOGY PANTNAGAR, U. S. NAGAR, UTTARAKHAND.

Natural plant and animal fibres have provided raw materials to meet the needs of mankind since ages. The leguminous plant Sesbania aculeata of Fabaceae family that provides variety of utility purposes including green manure, wood, fodder, cordage, fish nets, sackcloth and paper. The most appealing quality of plant is that it improves nitrogen content of soil, thus used as green manure. The low maintenance cost, fast and annual growing nature of plant offers an opportunity to conduct research for extracting valuable textile fibres. Hence, the present study was planned to measure the effect of chemical treatment applied for delignification on whiteness index of Dhaincha fibres. The effect of experimental parameters like chemicals' concentration and process time were assessed by response surface methodology using Box-Behnken design. The whiteness index of control Dhaincha fibres was -16.88. The fibres treated with acetic acid (2.5%), sodium chlorite (5%) and sodium hydroxide (1.5%) exhibited the minimum values of whiteness index (0.243) whereas the comparatively high values of whiteness index (7.166) were obtained by treatment with acetic acid (17.5%), sodium chlorite (35%) and sodium hydroxide (1.5%). The higher values of the whiteness index indicated that the fibers had improved whiteness. The experimental results depicted that there was a significant effect of acetic acid, sodium chlorite, sodium hydroxide and process time on the whiteness index of fibers. The interactive effect of these variables on whiteness index of Dhaincha fibers showed that with increase in the concentration of acetic acid and sodium chlorite the whiteness index also increased significantly. The improved whiteness index of Dhaincha fibres would enable diversification to varied end uses through its colouration.

Keywords: Delignification, chemical treatment, response surface methodology, whiteness index.

EMPOWERMENT THROUGH DECISION MAKING ROLE OF WOMEN INVOLVED IN APPLIQUÉ CRAFT OF PIPILI

MANASHI MOHANTY¹, MOUSUMI MISHRA¹, TRUPTII MOHANTY¹

¹DEPARTMENT OF FRM, COLLEGE OF COMMUNITY SCIENCE, O.U.A.T., BHUBANESWAR

To study the Socio-economic profile of rural women engaged in appliqué craft of Pipili. To know the participation of women in decision making activities of the family. For this study information was elicited by questionnaire cum interview method from 104 married women working in eight handicraft production units of Pipili. Data was elicited from the respondents at the production unit during their working hour as well as by visiting their household, as they spent most of the time in the production unit. The level of decision making by rural women engaged in the appliqué craft of Pipili was obtained by using Decision Making Index(DMI). According to the D.M.I score, the respondents were having medium participation in the decisions related to domestic activities (42.39) and money related matter (45.04). But their extent of participation was low in the decisions related to agricultural operation (34.61) and freedom of movement outside home (30.62). As per the findings, it seems that women in the study area do not enjoy a high degree of autonomy in decision making activities of the family although they are earning. It was observed that age has a significant impact on the extent of participation of women in various decision making activities.Empowerment is a gradual and consistent process, but women should build their mindset for taking additional effort willingly for their overall development. Steps should be taken to motivate the family members by providing opportunities to women for economic independence.

Key words: Economic empowerment, Resources, Rural women, Decision making

EFFECT OF INORGANIC AND BIO FERTILIZERS ON GROWTH AND YIELD OF ASALIO (*LEPIDIUM SATIVUM VAR. HLS-4*)

VANDANA, RAJESH LATHER, GURNAM SINGH AND SRI DEVI TALLAPRAGADA KRISHI VIGYAN KENDRA, PANCHKULA, CCS HARYANA AGRICULTURAL UNIVERSITY, HISAR

Keeping in view the importance of Asalio locally known as Chandershur as medicinal herb used in food and feed for mammals to increase quantity and quality of milk, a field experiment was conducted on the research farm of Medicinal Aromatic and Potential crops section, Department of Genetics & Plant breeding in CCSHAU, Hisar during rabi 2017-18 to study the effect of various doses of chemical fertilizers (N:P) and biofertilizers in different combinations on growth and yield of Asalio. Observations revealed that maximum plant height (118.7cm) was registered with the application of T₇ treatment *i.e.;* N: P 40: 20 kg ha⁻¹+ PSB at harvesting stage and lowest (103.1cm) with T₉ *i.e.;* N: P 80: 40 kg ha⁻¹ + PSB + AZB but no significant difference was found among the treatments. Significantly higher number of branches per plant (16.5) was recorded with the application of T₉ which was statistically at par with T₄ *i.e.;* N: P 80: 40 kg ha⁻¹ and T₃ *i.e.;* N: P 80: 40 kg ha⁻¹ + PSB. Lowest number of branches per plant (10.9) was recorded in T₇. Higher number of pods per plant (1126.6, 1056.6, 1045.5, and 1030.3) was registered with T₉, T₃, T₄ and T₁ respectively and significantly superior to other treatments. Lowest number of pods per plant (700.4) was observed in T₇. Maximum seed yield (1150 kg ha⁻¹), net return (Rs.36534/-) and B: C ratio (2.3) was fetched with the application of T₉ treatment *i.e.* N: P 80: 40 kg ha⁻¹ + PSB + AZB. Seed yield (T₉) was found superior to the other set of treatments but was at par with T₄ and T₃ treatments. Lowest seed yield (T₉) was observed in T₇ treatment T₇ *i.e.* N: P 40: 20 kg ha⁻¹ + PSB.

Key words: Asalio, Bio fertilizer, N: P, PSB, AZB

EMPOWERMENT THROUGH DECISION MAKING ROLE OF WOMEN INVOLVED IN APPLIQUÉ CRAFT OF PIPILI

MANASHI MOHANTY¹, MOUSUMI MISHRA¹, TRUPTII MOHANTY¹

¹DEPARTMENT OF FRM, COLLEGE OF COMMUNITY SCIENCE, O.U.A.T., BHUBANESWAR

To study the Socio-economic profile of rural women engaged in appliqué craft of Pipili. To know the participation of women in decision making activities of the family.For this study information was elicited by questionnaire cum interview method from 104 married women working in eight handicraft production units of Pipili. Data was elicited from the respondents at the production unit during their working hour as well as by visiting their household, as they spent most of the time in the production unit. The level of decision making by rural women engaged in the appliqué craft of Pipili was obtained by using Decision Making Index(DMI).According to the D.M.I score, the respondents were having medium participation in the decisions related to agricultural operation (34.61) and freedom of movement outside home (30.62). As per the findings, it seems that women in the study area do not enjoy a high degree of autonomy in decision making activities of the family although they are earning. It was observed that age has a significant impact on the extent of participation of women is a gradual and consistent process, but women should build their mindset for taking additional effort willingly for their overall development. Steps should be taken to motivate the family members by providing opportunities to women for economic independence.

Key words: Economic empowerment, Resources, Rural women, Decision making

MUSCULOSKELETAL DISORDER AMONG HILL FARM WOMEN INVOLVED IN VEGETABLE CULTIVATION

GARIMA PANT¹, NEENA VYAS² AND ARUNA RANA³

¹DEPARTMENT OF FAMILY RESOURCE MANAGEMENT, COLLEGE OF HOME SCIENCE, GBPUAT, PANTNAGAR ²DEPARTMENT OF FAMILY RESOURCE MANAGEMENT, COLLEGE OF HOME SCIENCE, CSKHPKV, PALAMPUR

Farming is a physically arduous occupation that places farm workers' at potential risk of musculoskeletal disorders, which has been observed to impose a greater impact on their health. Each activity in agriculture brings about certain stress and strain on bones and muscles leading to work-related musculoskeletal disorders which can lead to several permanent diseases and disabilities. A large number of workers including women are involved in the informal sector in India. A majority of them are engaged in agricultural sectors. The agricultural workers have to perform their jobs by putting manual labor and are exposed to different occupational stresses. The present study was aimed to evaluate postural stress and prevalence of musculoskeletal disorder (MSD) of women cultivators engaged in uprooting job of rice cultivation. These musculoskeletal disorders are the upshot of awkward posture and repetitive motion of hand wrist and other body parts. Women to use their traditional tools for their work. Musculoskeletal problems start as minor aches and pain, but when left unaddressed can result in serious injuries that can be permanently disabling the person. In addition, those painful injuries take long recovery periods and chances are that severely injured women may never be able to return to their job. It is evident that vegetable cultivation operation is performed continuously for longer duration as a result, worker is constrained and exhausted due to bending in the same position for prolonged period of time mainly in land preparation, weeding and harvesting with repetitive movements of the shoulders, head, arms, neck, back, fingers, and legs which causes muscle fatigue which leads to pain and injuries and is one of the major factors responsible for musculoskeletal problems among farm women involved in vegetable cultivation activity. The study reveals that there is need to take up more women oriented programmes and researches in agriculture and to implement ergonomic interventions with proper awareness among female agricultural workers.

Keywords: Musculoskeletal disorder, women, vegetable cultivation and postural stress

DETOXIFYING ENZYME STUDIES OF *SPODOPTERA LITURA* (FABRICIUS) FROM DIFFERENT REGIONS OF UTTARAKHAND FOR DEVELOPMENT OF INSECTICIDAL RESISTANCE

RASHMI JOSHI¹, NEETA GAUR AND SUDHA MATHPAL

DEPTT OF ENTOMOLOGY, COLLEGE OF AGRICULTURE, GBPUA&T, PANTNAGAR

Tobacco caterpillar, *Spodoptera litura* (Fabricius) is one of the economically important polyphagous pest in field and horticultural crops. In India it has been reported in almost all the major agricultural states. So far there is no such systematic biochemical study done on *S. litura* in Uttarakhand to study baseline resistance data by studying detoxifying enzymes activity from different geographical regions of Uttarakhand. In present study quantal response and biochemical profile of *S. litura* was studied for detoxification enzymes. The quantal response varied according to places such as Tanakpur, Almora, Mota-Haldu, Ramgarh, Bageshwar, Pithoragarh, Nainital, Pantnagar, Haridwar and Dehradun in reference to five insecticides used against them which were Indoxacarb, Fipronil, Lethal, Rocket and Chlorantraniliprole. It was found in studies that the results of Pantnagar were far different from other places. While studying biochemical profiles of detoxification enzymes it was observed that highest carboxylesterase activity was observed in insect population from Pantnagar. Other enzymes such as acetylcholinesterase, GST and P450 were also assessed and it was observed that population from plains showed higher enzymatic activity as compared to population from hills. Thus, the study revealed that places in which insecticides have been used indiscriminately show higher level of resistance and detoxification enzyme activity and hence adapt easily in growing crops. **Key words:** *Spodoptera litura*, Detoxification enzymes, Resistance, Uttarakhand

EFFECT OF MATURITY STAGES AND RIPENING PROCESS ON THE CHEMICAL PARAMETERS AND TOTAL ANTIOXIDANT ACITIVITY OF MANGO (MANGIFERA INDICA L.) VAR. MANJEERA

HIMANI JOSHI¹, M. NAGALAKSHMI² AND APARNA KUNA³

¹DEPARTMENT OF FOODS AND NUTRITION, GOVIND BALLABH PANT UNIVERSITY OF AGRICULTURE AND TECHNOLOGY, PANTNAGAR, UDHAM SINGH NAGAR, UTTARAKHAND

²PROFESSOR JAYASHANKAR TELENGANA STATE AGRICULTURE UNIVERSITY, RAJENDRA NAGAR, HYDERABAD ³MFPI-QUALITY CONTROL LABORATORY, PROFESSOR JAYASHANKAR TELENGANA STATE AGRICULTURE UNIVERSITY, RAJENDRA NAGAR, HYDERABAD

Present study was focused on analyzing the nutritive composition of ethylene treated mangoes at different days of storage to understand the right stage at which mangoes can be harvested for better nutritive potential which will ultimately lead to better health outcomes. Sixty mature green undamaged and healthy fruits of the Manjeera cultivar were harvested at two maturity stages (7-9°brix TSS and 9-11°brix TSS) and two ethylene ripening treatments (100ppm & 150ppm ethylene doses) were carried out at Fruit Research Station, SKLTSHU, Sangareddy. Control fruits were stored at 27°C-30°C in well-ventilated area and for accelerated ripening (100ppm & 150ppm ethylene) fruits were placed in chamber for 24 hours and withdrawn on 4th day, 8th day and 12th day for analysis. pH, TSS, Titrable acidity and Total Antioxidant acitivity was analyzed. Three factorial experiment was conducted and analysis of variance table was used to conduct a mixed factorial statistical analysis. Mangoes harvested in both the maturity stages were found to have an increase in pH content as the days of storage increased however the control mangoes had a higher pH content as compared to treated mangoes and since there is an inverse relation between pH and titrable acidity there was a decrease in titrable acidity as the days of storage increased.TSS content was found to be increasing during the storage of the mangoes however there was a slight decrease in few mangoes during 8th to 12th day of storage. Total antioxidant acitivity also varied as the days of storage increased for some mangoes there was an increase in TA activity whereas for some mangoes there was a decrease followed by increase.

Keywords: Manjeera, Total antioxidant acitivty, ethylene

WATERSHED MANAGEMENT; FUTURE CHALLENGES AND PROSPECTUS SHELLY BHATIA AND ROHIT KUMAR

UNIVERSITY INSTITUTE OF AGRICULTURE SCIENCE (UIAS), CHANDIGARH UNIVERSITY, MOHALI, CHANDIGARH In this era of ever increase population day by day, demand of water is increasing. But the water resources is rapidly depleting. Water is need of all the living organisms. The groundwater table is depleting due to over exploitation by humans. So, the concept of watershed management deals with to sustain and enhance watershed functions that effect the plant, animal, and human communities within watershed boundary. Watershed management plan is very beneficial for conservation of water. Acc. to Suhas P Wani and Kaushal K Gard: population Watershed is not simply the hydrological unit but also socio-political, ecological entity which plays crucial role in determining food, social and economic security and provides life support services to rural people. As the global population increases, the water for food production is becoming scarce resource. The rainfed agriculture contributes 58% to world's food basket from 80% agriculture lands. Management of natural resources at watershed scale produces multiple benefits in terms of increasing food production, improving livelihoods, protecting environment, addressing gender and equity issues along with biodiversity concerns. India is expected to become water stressed country by years 2020- 2050 with per capita water availability falling to 1341m3/person/year by 2025. Adequate supply of water for agriculture land can be done by watershed management. Recent technology like GIS and remote sensing helps us by quicker and cost effective analysis for various applications with accuracy for planning. It also gives a better perspective for understanding the problem and helps planners to evolve a better solution for sustainable development. In spite of sufficient rainfall, people have to depend upon tankers for domestic water supply because large amount of water is runoff which is responsible for both water as well as soil loss. When water flows along the slop, it carries soil along with it. It is estimated that more than 100 tons of soil is lost. Thus it help in utilizing primary source of water and prevent runoff from going into sewer or storm drains. The main aim of watershed management is maximum utilization of surface water as well as ground water. Monsoon water and ground water is supplementary so their management is continues process. During scarcity of water or inadequate rainfall, one can depend on ground water. And the excess rain water can be used to saturate groundwater reservoir instead of allowing it to be lost by runoff.

Key words: groundwater, environment, Monsoon, Watershed management

TO STUDY THE POPULATION DYNAMICS OF BIHAR HAIRY CATERPILLAR (*SPILARCTIA OBLIQUA*) ON LINSEED, *LINUM USITATISSIMUM* (LINN.) AND THEIR RELATIONSHIP WITH ABIOTIC FACTORS

MOHAMMAD RIZWAN¹, UMESH CHANDRA², MOHAMMAD IMRAN³ AND MUZEEV AHMAD⁴

¹DEPARTMENT OF ENTOMOLOGY, SARDAR VALLABHBHAI PATEL UNIVERSITY OF AGRICULTURE AND TECHNOLOGY MEERUT (U.P.)

²DEPARTMENT OF ENTOMOLOGY, NARENDRA DEVA UNIVERSITY OF AGRICULTURE AND TECHNOLOGY KUMARGANJ AYODHYA

³DEPARTMENT OF GENETICS AND PLANT BREEDING, SARDAR VALLABH BHAI PATEL UNIVERSITY OF AGRICULTURE AND TECHNOLOGY, MEERUT (U.P.)

⁴DEPARTMENT OF HORTICULTURE, SARDAR VALLABHBHAI PATEL UNIVERSITY OF AGRICULTURE AND TECHNOLOGY MEERUT (U.P.)

The experimental trial was carried out at the student instructional farm of Narendra Deva University of Agriculture & Technology, Narendra Nagar (Kumarganj), Ayodhya. The site is located at 42 km away from the district head quarter, Ayodhya on Ayodhya -Raibareily road. The linseed genotype was sown in protected plot in Randomized Block Design with 3 replications. The plot size was 10x10 sqm. The sowing was done on the last November. In addition to this all normal recommended agronomical practices were followed. The meterological data was collected from the Department of Agrometerology, N.D.U.A.&T., Kumarganj, Ayodhya (U.P.) The study was carried out on the effects of various weather parameters like temperature (minimum and maximum), Relative humidity (%), Rainfall (mm) and Sunshine (hr) on incidence of Bihar hairy caterpillar (*Spilarctia obliqua*) on variety Neelum of Linseed. The incidence of Bihar hairy caterpillar (0.335 and 0.586), relative humidity (0.086), rainfall (0.233) and sunshine hours (0.046), during *Rabi* 2012-13. The larvae of this voracious foliage feeder were recorded in the late vegetative stage of the crop during the last week of January and first week of March in Neelum. The peak in population 4.91 per plant was recorded in first week of March in variety Neelum during 2012-13.

Key words: Population Dynamics, Bihar Hairy Caterpillar, Linseed, Abiotic factors.

GENETIC VARIABILITY AND STABILITY ANALYSIS FOR SOME QUANTITATIVE CHARACTERS IN GLADIOLUS (GLADIOLUS GRANDIFLORUS L.)

¹PUSHPENDRA VERTY ²V.M PRASAD AND ³MANOJ NAZIR 1. SCHOOL OF AGRICULTURE, ITM, UNIVERSITY GWALIOR 2. DEPARTMENT OF HORTICULTURE, SHUATS, ALLAHABAD

3. DIRECTORATE OF AGRICULTURE, JAMMU

Experiment on Gladiolus was carried out at Sam Higginbottom University of Agriculture, Technology & Sciences, Prayagraj and Directorate of Agriculture, Research Field (Floriculture) Jammu for two years during 2013-2104 to 2014-2015 in order to study the genetic variability, heritability, genetic advance, correlation coefficient and stability of eighteen quantitative characters in gladiolus. Twenty genotypes of gladiolus were grown in randomized block design (RBD) with three replications at Allahabad & Jammu. Analysis of variance (ANOVA) revealed that Mean square due to treatments were significant for most of the characters in all the four environments except for number of florets open at first, number of shoots per plant, number of leaves per shoot, number of corms per plant for all the four environments and average weight of cormels per plant in (E₂) Jammu. The PCV were higher than GCV for all the character studied for all the environments, indicating high degree of environmental influence. Higher GCV and PCV estimates were found for number of cormels per plant for Prayagraj (E_1 and E_3) and cormels per plant and corm per plant for Jammu (E_2 and E_4). Heritability in broad sense was found to be high for mostly characters studied in all the environments. Low heritability recorded for the characters viz; Diameter of corm Allahabad (E1), floret remain open at a time and shoot per plant at Allahabad (E1) Jammu for the characters durability of whole spike (E2 and E₄) and florets open at First(E₄). Number of cormels per plant showed moderate to high heritability along with high genetic advance showing additive gene effects. All the genotypic correlation coefficient were higher than phenotypic correlation coefficients. Days to first floret colour showing was positively correlated with days to first floret opening in most of the environments. Days to 50% heading, days to first floret colour showing, days to first floret opening showed significant positive correlation with days to first floret colour showing in most of the environments showed significant positive correlation with corms/plant in most of the environments and rachis length showed significant positive correlation with plant height(cm). Therefore, selection for former characters will be of great significance in a crop like gladiolus, since it increases the aesthetic value of the cultivars. Considering all the floral characters cutivars ArkaAmar, Charm Flow, Green Bay, Poppy Tears, Red Ginger, Punjab Dawn, Darsan, Red Mejestry and Legent were found suitable for commercial cultivation under northern Indian (Prayagraj & Jammu). The promising cultivars for corm and cormels production are Poppy Tears, Candy Man, Hunting Song and Jester.

Key words: GCV, PCV, Heritability, Correlation Coefficient, Stability and Gladiolus.

CARBON SEQUESTRATION POTENTIAL OF AGRI-HORTI-SILVICULTURE SYSTEM IN KUMAUN HIMALAYA, INDIA NEELU LODHIYAL

DEPARTMENT OF BOTANY, D.S.B. CAMPUS, KUMAUN UNIVERSITY, NAINITAL-263001, UTTARAKHAND, INDIA

The rapid population growth and reduction in per capita land area has resulted into shifting of sole cropping system to Agroforestry system. Agroforestry is an important land use system for sustainable forestry and agriculture. Present study deals with agri-horti-silviculture (AHS) system in which farmer raised fruit (litchi and guava) and forest trees (poplar and eucalyptus) deliberately integrated with agricultural crop i.e., wheat in winter and black bhatt in summer season on the same land unit area. Objective of the study was to assess biomass, net primary productivity, and carbon potential in agri-horti-silviculture system in Shiwalik plain of Kumaun Himalaya. Tree density and basal area was 1020 ind ha⁻¹ and 7.28 m² ha⁻¹ in AHS system. Species diversity was found higher 1.574 in AHS system as compared to sole system. The biomass and carbon stock of tree was 188.26 t ha⁻¹ and 89.42 t C ha⁻¹. The CO₂ mitigation was 328.15 t C ha⁻¹ in agri-horti-silviculture system was 49.81 t ha⁻¹ yr⁻¹ of which tree, agriculture crop and weed accounted for 51.7, 33.1 and 15.2 %, respectively. Based on the present findings, it is concluded that agri-horti-silviculture system is a better land use system for the conservation of biodiversity, production of dry matter, sustainability of land and mitigate the climate change problems through sequestration process. Agri-horti-silviculture system can be a sustainable way to fulfill the present day needs. This system provides diverse products; improve the socio-economic status of rural people and more environmental benefits. **Keywords**: biomass, agriculture, agri-horti-silviculture system, climate change, mitigation

INSCETS A SUSTAINABLE SOURCE OF FOOD AND NUTRITIONAL PERSPECTIVE: A CRITICAL REVIEW

MRIGANKA SHEKHAR BORAH

DEPARTMENT OF HORTICULTURE (FOOD TECHNOLOGY PROGRAMME), ASSAM AGRICULTURE UNIVERSITY, JORHAT, ASSAM

Insects as a major animal group possess enormous biodiversity and form a colossal biomass in nature that generally is wasted. Increasing world population worsens the serious problem of food security in developing countries. On the other hand in industrialized countries, where the problem of food security is of minor concern, health problems related to food refer to two main factors: food safety and environmental sustainability of food production. Insects offer us many benefits, including their use in human and animal nutrition, in medicine. religion, art, and handicrafts. Also, they are efficient recyclers of organic matter and provide a source of economic gain for the poor through their commercialization. Up to date we have recorded around 2000 different edible insect species in the world. Because of their high nutritive value and ubiquitous presence, insects present a potential sustainable food source for humans. Insects are highly nutritious and especially rich in proteins and thus represent a potential food and protein source. A compilation of 236 nutrient compositions in addition to amino acid spectra and fatty acid compositions as well as mineral and vitamin contents of various edible insects. edible insects provide satisfactorily with energy and protein, meet amino acid requirements for humans, are high in MUFA and/or PUFA, and rich in several micronutrients such as copper, iron, magnesium, manganese, phosphorous, selenium, and zinc as well as riboflavin, pantothenic acid, biotin, and in some cases folic acid. Liabilities of entomophagy include the possible content of allergenic and toxic substances as well as antinutrients and the presence of pathogens. More data are required for a thorough assessment of the nutritional potential of edible insects and proper processing and decontamination methods have to be developed to ensure food safety. For these reasons, new ways must be found to increase yields while preserving food quality, natural habitats, and biodiversity. Insects could be of great interest as a possible solution due to their capability to satisfy 2 different requirements: (i) they are an important source of protein and other nutrients; (ii) their use as food has ecological advantages over conventional meat and, in the long run, economic benefits. However, little is known on the food safety side and this can be of critical importance to meet society's approval, especially if people are not accustomed to eating insects. Key words: Sustainable, Entomophagy, Edible insects, Antinutrients

ELDERLY NEGLECT WITH SPECIAL EMPHASIS ON INDIAN PERSPECTIVE: FORENSIC ENTOMOLOGICAL DETERMINANTS

SWAIMA SHARIF, AYESHA QAMAR, TABASSUM CHOUDHARY AND MUNAWWAR HUSAIN ALIGARH MUSLIM UNIVERSITY, ALIGARH

In India, the problem of looking after the elderly is accentuated as compared to the rest of the world. This is compounded by the shrinking space in the household, poor socioeconomic status, ambition, and do-not-care attitude in young adults. Consequently, the offshoot is that the elderly get neglected and drained off of their physical energy, mental, and emotional composite. Forensic entomology is an important determinant for abuse and neglect of the elderly. Insects evidence may also represent for how long a person was abused/neglected. The open wounds, urine/stool-soaked clothes and bed attract certain species of Dipterans who oviposit, feed, and complete their life cycle on the body of a living person, particularly in cases of incapacitated and enfeebled elderly. In the current paper, the authors have picked out the identification, characterization, and colonization of forensically important insects invading such older adults who are unable to take care of their personal hygiene and health. Care has been taken to make it a technical study by the consolidation of forensic entomology with *Res Ipsa Loquitor* (the thing or fact speaks for itself) to determine the neglect of the elderly. The legal provisions enshrined in Indian law related to the maintenance and welfare of older persons and prevailing collateral issues have also been imbibed in the study to make it fair in the perspective of Indian conditions and the environment. Having said that, the study is wide enough to give it a global phenomenon. **Keywords**: Forensic entomology, Elderly neglect, Dipterans, Forensic entomological determinant.

EFFECT OF CONSECUTIVE SOWINGS AND SPACING ON GROWTH AND YIELD OF AMARANTH D. LAKSHMI PRASANNA, <u>Y. R. PARULEKAR,</u> B. R. SALVI, P. M. HALDANKAR AND O. A. NIRMAL DEPARTMENT OF HORTICULTURE, COLLEGE OF HORTICULTURE, DAPOLI, DISTRICT - RATNAGIRI (MS) DR. BALASAHEBSAWANT KONKAN KRISHIVIDYAPEETH, DAPOLI

Amaranth is important leafy vegetable cultivated in Konkan region of Maharashtra. This vegetable is nutritionally superior as it contains high level ofFe,fibersand ascorbic acid. Due to its short duration (around 30 days) more than 6 crops can be taken is from September to May. The land holding in Konkan is very small and many times same piece of land is continuously utilized for growing of the crop. Many times it may result in reduction of yield and quality. The reduction in yield can be compensated by reducing the line spacing. Hence, to assess the effect of consecutive sowing and different spacing on growth and yield of amaranth, the present investigation was carried out during rabi season, 2018-19 conducted at Department of Horticulture, College of Horticulture, Dapoli in Factorial RBD with three replications consisting of two factors i.e. First factor - Consecutive sowings *viz.*, C1- Sowing during second fortnight of October, C2-Sowing during second fortnight of November, C3- Sowing during second fortnight of December. Second factor -Spacing *viz.*, T1 (20 cm spacing between two rows), T₂ (30 cm), T₃ (40 cm) and T4-Broadcasting.Among the different interaction between spacing and consecutive sowing, highest yield was obtained from C3T₁ combination.The best treatment combination with high B :C ratio were observed C₃T₁.Planting at closure spacing (20 cm) should be adopted for higher yield without affecting the quality parameters. **Keywords**: Amaranth, consecutive sowing, spacing, growth and yield.

NON CHEMICAL APPROACHES FOR INDUCTION OF APPROPRIATE FLOWERING IN MANGO CV. ALPHONSO O. S. WARANG, P. M. HALDANKAR, Y. R. PARULEKAR, S. A. CHAVAN, B. R. SALVI, N. V. DALVI, A.V. BHUWAD AND S. B. MANE

DEPARTMENT OF HORTICULTURE, COLLEGE OF HORTICULTURE

DR. BALASAHEB SAWANT KONKAN KRISHI VIDYAPEETH, DAPOLI-415 712, MAHARASHTRA

Alphonso mango is important cash crop of Konkan region. The early harvesting of the fruits is of immense importance for fetching attractive market rate. In recent years, the climatic aberration such as delayed rains especially during initiation of flowering in month of September and October in mango cv. Alphonso result in production of vegetative shoots instead of flowering panicles in spite of application of paclobutrazol. It delay harvesting causing financial loss to the growers. The non-chemical approaches such as girdling and tip pruning have shown promising results in induction of flowering in fruit crops. Theexperiment entitled "Non chemical approaches for induction of appropriate flowering in mango cv. Alphonso." was conducted with eight treatments viz., T₁- Girdling on first fortnight of September and removal of new shoots, T₂- Girdling on first fortnight of October, T3- Girdling on first fortnight of October and removal of new shoots, T₆- Girdling on first fortnight of September and Girdling on first fortnight of September and Girdling on first fortnight of new shoots, T₆- Girdling on first fortnight of control which were replicated three times. Girdling on first fortnight of September and removal of new shoots, T₆- Girdling on first flowering, hermaphrodite flowers percentage and maximum fruit set and fruit retention. The physical and chemical parameters of fruits did not varied due to girdling and removal of new shoots.

Keywords: Mango, Alphonso, girdling, pinching, flowering, fruit set, yield.

IMPACT OF LIGHT IN FRUIT CROP PRODUCTION

RAJNI RAJAN^{*1}, M. FEZA AHAMAD² AND KULDEEP PANDEY³

^{1,2}DEPARTMENT OF HORTICULTURE (FRUIT & FRUIT TECHNOLOGY) BIHAR AGRICULTURAL UNIVERSITY, SABOUR 813 210, BHAGALPUR, BIHAR

³DEPARTMENT OF FRUIT TECHNOLOGY, ICAR-INDIAN AGRICULTURAL RESEARCH INSTITUTE, NEW DELHI-110012

Light interception by leaves is essential for the growth and survival of fruit trees because it enables plants to convert energy from light into sugar to fuel flowering and fruit growth. It is essential that the leaves closest to developing fruit (in both fruit and nut tree crops) intercept enough light to ensure high quality crop production. The positive influence of artificial lighting on plant growth, yield and quality. It is often assumed that an increment in light intensity results in the yield increase. Light quality (sunlight spectrum) management promises to provide a new technological alternative to sustainable production in horticultural crops. Sunlight composition changes widely in orchard canopies, inducing different plant responses in fruit trees mediated by phytochrome (PHY) and cryptochrome (CRY) activity. High proportion of farred (FR) in relation to red (R) light increases shoot elongation, while blue (B) light induces shoot dwarfing. Red and ultraviolet (UV) light increases fruit skin anthocyanin synthesis, while FR light shows a negative effect. Red and B light can also alter leaf morpho-physiological traits in fruit trees, such palisade thickness, stomatal aperture, and chlorophyll content. Impact of light in fruit color, fruit weight, shoots growth reported in apple (*Malus domestica* Borkh.), peach (*Prunus persica* [L.] Batsch), and sweet cherry (*Prunu savium* [L.] etc. **Keywords**- Light, Plant, Fruit, Yield, Quality etc.

STUDIES ON THE EFFECT OF INTEGRATED NUTRIENT MANAGEMENT IN ENHANCING THE PRODUCTIVITY OF MAIZE-WHEAT CROPPING SYSTEM IN MID HILLS OF HIMACHAL PRADESH. KARAN VERMA¹ AND A.D. BINDRA²

¹DEPARTMENT OF AGRICULTURE, MAHARISHI MARKANDESHWARUNIVERSITY, AMBALA, HARYANA

²DEPARTMENT OF AGRONOMY, FORAGES AND GRASSLAND MANAGEMENT, CSK HIMACHAL PRADESH KRISHI VISHVAVIDYALAYA, PALAMPUR, HIMACHAL PRADESH- 176062 INDIA

Seven integrated nutrient management treatments in maize viz., 50% N through FYM + 50% N through inorganic fertilizer; 50% N through fortified vermicompost + 50% N through inorganic fertilizer; 25% N through FYM + 75% N through inorganic fertilizer; 25% N through fortified vermicompost + 75% N through inorganic fertilizer; 25% N through vermicompost + 75% N through inorganic fertilizer; 25% N through vermicompost + 75% N through inorganic fertilizer; 25% N through vermicompost + 75% N through inorganic fertilizer; 25% N through vermicompost + 75% N through inorganic fertilizer; 25% N through vermicompost + 75% N through inorganic fertilizer; 25% N through vermicompost + 75% N through inorganic fertilizer; 25% N through vermicompost + 75% N through inorganic fertilizer; 25% N through vermicompost + 75% N through inorganic fertilizer; 25% N through vermicompost + 75% N through inorganic fertilizer; 25% N through vermicompost + 75% N through inorganic fertilizer; 25% N through vermicompost + 75% N through inorganic fertilizer; 25% N through vermicompost + 75% N through inorganic fertilizer; 25% N through vermicompost + 75% N through inorganic fertilizer; 25% N throug

treatment combinations, were evaluated for two consecutive years commencing from kharif, 2015 to rabi, 2016-17 at Palampur in maizewheat cropping sequence. In the first kharif season seven fertility treatments in maize were evaluated in randomized block design with three replications. Subsequently from rabi, 2015-16, the treatments in maize were assigned to main plots and those in wheat to sub plots in a split plot design. Integrated organics and inorganics application to maize significantly improved the growth, yield attributes, grain and stover yield of maize at par with 100% inorganics. Treatments receiving organics for substituting 25% N either through fortified vermicompost or vermicompost (T_5 and T_6) gave higher numerical values among the organics and inorganics combinations. Residual effects on wheat growth, yield and yield attributes were not significant. Higher NPK uptake and improved soil physical properties viz., infiltration rate as well as microbial biomass carbon were recorded with combined application of organics and inorganics after maize and wheat. Fertilizer application to wheat with 100% NPK significantly enhanced wheat growth, yield and yield attributes and profitability of wheat as well as soil physical properties. Higher gross returns, net returns and BC ratio were observed with recommended NPK and 25% N through fortified vermicompost + 75% N through fertilizer (T_5) to maize in maize-wheat cropping system which were found at par with 100% NPK to maize crop.

Keywords: INM, M-W, Growth, Yield and Productivity

ROLE OF MUNICIPAL SOLID WASTE MANAGEMENT IN THE ENVIRONMENT RAVINDER

IGNOU-NEW DELHI.

India generated 1, 27,486 tons per day of solid waste during 2011-12. It is estimated that 89,334 TPD (70%) of this MSW was collected and only 15,881 TPD (12.45%) was processed or treated (CPCB Status Report, 2011-12). This underlines the urgency of the necessity and potential for proper MSW disposal. Various options for waste treatment and disposal include aerobic and anaerobic digestion, vermicomposting, incineration, gasification and landfilling. One of the latest conflicts encountered in MSW disposal is that between energy and material recovery. In Indian scenario the main issues is to dispose and processing of waste collected at dumping sites at different levels of Urban and Rural areas like City, Villages and other developed areas where it is required to process and disposal of waste collected from various establishments. It is a Unique type of project in which various types of waste collected from different type of generators like Residential, Commercials, institutional and other establishments which generate waste in a regular/daily basis. In the Indian scenario, the main physical characteristics of the solid waste are Organic waste, Dust, Paper, Plastic, Glass, Metal, Bio Medical Waste, Card Board, Rubber, Miscellaneous and etc. These types of waste are disposed and processed through various scientific methodology like Reduced Density Fuel (RDF), Material Recovery Facility(MRF), Compost, Landfill development. These are the methods in which we can disposed the waste and convert into in other form from waste to wealth. Our concept of research is focus on Environment, which is related with Waste management and processing of waste collected and dumped in the dumping site in Municipalities/Villages of India. We are working to provide a solution for garbage free city/villages. We need to work for Management and Processing of Solid waste management. We will plan to process the waste in a Eco-friendly manner which will not harmful to our environment and surroundings. Key words: Solid Waste Disposal and Processing, RDF, MRF, Landfill Development.

TRADITIONALLY PROCESSED FISH PRODUCTS OF ASSAM: A REVIEW MANSI TIWARI¹, MRIDULA SAIKIA BAROOAH¹, PREMILA L. BORDOLOI¹ ¹DEPARTMENT OF FOOD SCIENCE AND NUTRITION, COLLEGE OF COMMUNITY SCIENCE, ASSAM AGRICULTURAL UNIVERSITY, JORHAT

Assam, a state of North-Eastern region of India is a veritable paradise comprising rich and diverse cultural grandeur, filled with energetic and enthusiastic people bearing traditional or ancestral knowledge and wisdom about natural resources. A number of ethnic food products are prepared using traditional techniques by different tribes/communities of the region. Fish being an integral part of Assamese cuisines are traditionally processed to suite the purpose of preservation and for enhancement of taste, flavour, aroma or other quality attributes. Fish processing generally employs drying, salting, smoking and fermentation. *Shidal, Hukoti, Numsing, Chucha, Naduba Siyan, Napham, Nkham* and *Nichaow* are some of the popular traditionally processed fish products of Assam. *Shidal* is a fermented fish product prepared from dried *Puntius spp.* of bigger size while *Hukoti* is a dry fish product prepared from small fatty fish by communities like *Moran, Motak, Ahom, Chingfou* etc. Fish product of *Missing* community, *Numsing* is semi dried- semi smoked and consumed as condiment to complement the main dish. *Chucha* and *Naduba Siyan* are some of the popular fermented fish products of *Bodo, Garo* and *Rabha* communities respectively. These indigenous fish products in addition to a longer shelf life have a better nutritional and medicinal value, however due to lack of popularization and proper documentation, these products are limited to some communities. **Key words:** Processed, fish product, Assam, indigenous, traditional

ASSOCIATION ANALYSIS AMONG FUNGI, COLONIZING WHEAT CROP RESIDUES DURING DECOMPOSITION". FOR SUSTAINABLE AND ENVIRONMENT-FRIENDLY MANAGEMENT OF RENEWABLE NATURAL RESOURCES.

RAJ SINGH¹, SUSHIL KUMAR UPADHYAY¹, ANJU RANI², PERMOD KUMAR² AND AMIT KUMAR³

¹DEPARTMENT OF BIOTECHNOLOGY, MAHARISHI MARKANDESHWAR (DEEMED TO BE UNIVERSITY), MULLANA-AMBALA-133207 (HARYANA), INDIA

²DEPARTMENT OF BOTANY, SUBHARTI COLLEGE OF SCIENCE, SWAMI VIVEKENAND SUBHARTI UNIVERSITY, MEERUT-250005, UTTAR PRADESH, INDIA

³DEPARTMENT OF BIOTECHNOLOGY, SUBHARTI COLLEGE OF SCIENCE, SWAMI VIVEKENAND SUBHARTI UNIVERSITY, MEERUT-250005, UTTAR PRADESH, INDIA

The interspecific associations between selected fungal species were calculated on the basis of the assumption that the species occurring together in Petri dishes during isolation from litter might be associated as well. For the purpose of association analysis, each Petri dish was considered as a quadrat. The presence and absence of different species in the Petri dishes at different sampling dates were recorded as is done in grasslands by quadrat method. In the present study the interspecific association between 16 fungal species was evaluated. Isolated during the decomposition of above ground residues of wheat crop. About 136 combinations were analyzed. The (chi square) χ^2 values were

calculated to assess the significance of association (positive or negative) and the coefficient of association (V) was also calculated to find out the extent of association between the species in nature. Any organisms is influenced by the abiotic and biotic factors constituting its environment. The fungi are no exception – the colonization of a substrate by a fungus and its survival and multiplication depends upon the environment it gets. Therefore, before using any fungus as bioinoculant, we must make sure that other microbes specially the fungi already present on the substrate do not have negative impact on it. An analysis of the association between the species colonizing the substrate would be helpful in determining the bioinoculant to be used for the degradation of organic waste in the interest of environment to make it safe for everyone.

Key word: Association analysis, chi square value (χ^2), coefficient of association (V) wheat crop and fungal decomposer

INTELLECTUAL PROPERTY RIGHTS: AN OVERVIEW AND EMPHASIS IN AGRO PROCESSING ER. ALKA SHARMA*, DR. RANJEET SINGH & DR. R.K. VISHWAKARMA ICAB, CENTRAL, INSTITUTE OF POST, HARVEST ENCINEERING, AND TECHNOLOGY

ICAR-CENTRAL INSTITUTE OF POST - HARVEST ENGINEERING AND TECHNOLOGY

Intellectual property rights are like any other property right and have been defined as ideas, inventions, and creative expressions based on which there is a public willingness to bestow the status of property. IPR provide certain exclusive rights to the inventors or creators of that property, in order to enable them to reap commercial benefits from their creative efforts or reputation. Types of intellectual property relevant to the agro processing include patents, plant varieties, trade marks, copyright, trade secrets and design rights. Agriculture plays a vital role in India's economy. The Indian food industry is poised for huge growth, increasing its contribution to world food trade every year due to its immense potential for value addition, particularly within the agro processing industry. In the agri-food industry, an innovative production process, manufacturing process, product formulation or new packaging marketed under a brand name (trademark) will usually constitute valuable IP. These assets can be extremely valuable, particularly when a company becomes successful. If any form of intellectual property is not protected at the beginning, its value can be lost, stolen or diminished. IPR is prerequisite for better identification, planning, commercialization, rendering, and thereby protection of invention or creativity. Promoting agro processing based unique/innovative start ups under Creative India, Innovative India scheme will lead to its increased valuation and is likely to attract more investors. Thus IPR, in this way aids the economic development of a country by promoting healthy competition and encouraging industrial development and economic growth, as IPR cements the integrity of brands and is at the heart of a modern economy. **Keywords**: intellectual property, agro processing, start ups

DEVELOPMENT OF BANANA BASED VALUE ADDED READY TO SERVE DRINK WITH NATURAL PRESERVATIVES <u>SIMRAN ARORA</u>, SALEEM SIDDIQUI, RAKESH GEHLOT AND NASEER AHMED

CENTRE OF FOOD SCIENCE AND TECHNOLOGY, CCS HARYANA AGRICULTURE UNIVERSITY, HISAR

The present investigation was carried out to develop and evaluate ready-to-serve (RTS) banana based drink having 20% pulp, 15% TSS and 0.28% acidity. The objectives of this study is to study the effect of various natural preservatives on the shelf life of developed ready-to-serve drink. Fresh carrot, beet root juices and ripe or over-ripe banana pulp were utilized for preparation value added ready to serve (RTS) drinks. The RTS drink variants were bottled in 200 ml capacity sterilized glass bottles, pasteurised and stored for three months at room temperature (25+2°C) for analysing its quality and sensory attributes at monthly intervals for three months. The value added RTS drink variant with 20% banana pulp, 15% TSS, 0.28% acidity, 0.68% spice mixture and carrot + beetroot (9:1) juice @ 50% was found to be most acceptable. Among the various preservatives used, it was observed that sodium benzoate @ 100ppm and nisin @ 40 mg/l were most acceptable on the basis of sensory scores of RTS drinks. There was an increase in TSS, total and reducing sugars, acidity, and non-enzymatic browning, while a decrease was observed in pH, ascorbic acid, total carotenoids, phenols, anthocyanins, betanins and total antioxidants of RTS drink variants during storage. The total plate counts (TPC) during storage were lower in RTS drinks containing no preservatives were microbiologically safe upto two months only and became unsafe by three month of storage. The retention of organoleptic overall acceptability scores during storage was higher for value added RTS drinks containing natural preservative nisin. **Key words:** Banana pulp, carrot juice, beet root juice, RTS drink, natural preservatives

THE EFFECTS OF DRYING METHODS ON LOSSES OF VITAMINS AND ANT- NUTRITIONAL QUALITY OF FRESH AND PROCESSED BUCKWHEAT (*FAGOPYRUM ESCULENTUM MOENCH*) LEAVES

MONIKA VERMA¹, RITA SINGH RAGHUVANSHI², <u>AKANKSHA SINGH^{3*}</u>

DEPARTMENT OF FOODS AND NUTRITION, G.B. PANT UNIVERSITY OF AGRICULTURE AND TECHNOLOGY, PANTNAGAR (UTTRAKHAND) INDIA

Buckwheat (Fagopyrum esculentum Moench) has been a popular health food in Asian and European countries for a long time. Recognizing the nutrient content and health benefits, buckwheat grain as well as leaves can play an important role in alleviating widespread micronutrient deficiencies and improving health condition of population. Drying as a form of processing ensures the availability of perishable items like leafy vegetables all year round. This study aimed at analyzing nutrient composition of buckwheat leaves and comparing the effects of traditional sun drying with other drying methods on the vitamins (vitamin C and \beta-carotene) and anti-nutrients composition (Glucosinolate, tannin, oxalate and phytate) of fresh and processed buckwheat leaves. Local variety of buckwheat leaves were purchased from Haldwani market, Uttrakhand. Fresh mature leaves were washed and a part of buckwheat leaves were steam blanched. Both blanched and unblanched leaves were dried in vacuum oven for 24 to 28 hour, in hot air oven for 8 to 10 hours and in sun for 35 to 40 hours. Dried leaves were ground and packed in sealed bags. Only vitamins and anti-nutrients were analyzed in differently processed leaves. In the present study, blanched and unbalanced buckwheat leaves were dried at three types of drying operation traditional sun drying, vacuum drying and oven drying, and then showed the effect of losses of nutrients like some vitamins and anti-nutritional content in differently processed buckwheat leaves. The results showed that fresh leaves had 2748 μ g/100gm β -carotene and 25.7mg/100 vitamin C. Phytate, oxalate, tannin content of buckwheat leaves was 4.72, 440.5 mg/100gm and 9.32×10-4 µg/100gm, respectively implying that the calcium and iron bioavailability from buckwheat leaves is not appreciable. Both in case of blanched and unblanched leaves, oven drying method leads to more losses (β-carotene 19.34 and 34.17%, vitamin C 44.86 and 34.29%) of followed by sun drying and vacuum drying. Blanched buckwheat leaves had significantly less amounts of anti-nutrient contents and oven drying caused maximum

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loss of anti-nutrient both in case of blanched and unblanched leaves. Thus it may be concluded that vacuum drying leads to minimal losses of vitamins. Buckwheat Leaves are a rich source of β -carotene can be successfully used 5-6 gram/day to take care of micronutrient deficiencies of population and powder can be preserved long time for different uses with best nutrient and minimal anti-nutrient content.

SOIL CARBON SEQUESTRATION IN HOMEGARDENS OF DIFFERENT ALTITUDE AND SIZE IN NAINITAL DISTRICT OF UTTRAKHAND, INDIA KIRAN BARGALI AND VIBHUTI

DEPARTMENT OF BOTANY, DSB CAMPUS KUMAUN UNIVERSITY, NAINITAL-263001(UTTARAKHAND)

Trees in homegardens (HGs), contribute to climate change mitigation through enhanced soil carbon sequestration. Soil samples at two depth classes (0-15cm and 15-30 cm) were collected from HGs of varying age and altitude across Nainital district of Uttarakhand, India. HGs were categorized as: Very low altitude (up to 350 m), low altitude (350-700 m), mid altitude (700-1500 m) and high altitude (above 1500 m); Small HGs (<0.004 ha ha), Medium HGs (0.005-0.007 ha) and Large HGs (>0.008 ha). Soil organic carbon (SOC) and carbon stock (SCS) at two soil depths in these HGs were estimated. Along the altitudinal gradient, the maximum value of SOC was observed at mid altitude (4.44 %), while minimum value (2.39 %) was observed at very low altitude. Across the homegarden size, minimum value of SOC (2.24 %) was observed in large homegardens, while maximum value (5.20 %) was observed in small homegardens. Soil organic carbon decreased significantly (p<0.05) with increasing soil depths in the HGs. However, deeper layers of high altitude HGs recorded more soil organic carbon content than those of low altitude HGs. The SCS ranged from 35.75 to 60.69 t C ha⁻¹ and was maximum in medium sized homegardens. The maximum values of SCS (60.69 t C ha⁻¹) were observed in mid altitude homegardens, while minimum value (35.75 t C ha⁻¹) was observed in very low altitude. In this study, amount of CO₂ mitigated by homegarden soil ranged from 123.06 to 242.83 t C h⁻¹. The potential of homegarden agroforestry for C sequestration depends on the biologically mediated uptake and conversion of CO₂ into inert, long-lived, C-containing materials, a process termed as bio-sequestration. Higher SOC pools in homegarden system can be particularly achieved by increasing the amount of biomass C returned to the soil and by strengthening soil organic matter stabilization and/or by decreasing the rate of biomass decomposition.

Key words: Homegardens, Soil organic carbon, Soil Carbon Stock Soil Carbon Sequestration,

SEED MATURATION INDICATORS OF *FICUS GLOMERATA* ROXB. IN NAINITAL DISTRICT OF KUMAUN HIMALAYA JYOTSNA

DEPARTMENT OF FORESTRY AND ENVIRONMENTAL SCIENCE, D. S. B. CAMPUS KUMAUN UNIVERSITY NAINITAL

Ficus glomerata Roxb. (Moraceae) popularly known as goolar is a deciduous tree common all over India in outer Himalaya, Australia, South East Asia and Malaysia, is found up to an elevation of 1800 m above sea level. Fruits are red when ripe, borne on short leafless branches emerging from the trunk and the main branches. It is used in many countries as an edible fruit and management of several disease including diabetes. The present study was carried out to study the seed and fruit character of *Ficus glomerata* at different altitudes viz, 239 m, 245 m and 254 m in Nainital district of Kumuan Himalaya across three sites. The study area lies between 29'00° N latitude and 79'41° E longitude. It was observed that the species flowers throughout the year and fruits mature at several times in a year January - February, April - March, July - August and October - November. Fruits of *Ficus glomerata* were collected from five average sized healthy trees. During the study period colour of fruits changed from green to red. The mean fruit size ranged between 101.19 ± 1.13 and 774.67 ± 4.68 mm² across all the sites. The seed size varied between 1.50 ± 0.08 and 2.41 ± 0.08 mm² across all the sites. The maximum germination ranged between 53.28 ± 2.38 and 58.00 ± 1.15 % when the seed moisture content was 35.19 ± 1.77 to 40.16 ± 0.65 %. The best time of fruit collection for multiplication of the species is between in the month of July to August. Seed germination and seed moisture content was negatively correlated. Maturity and germination of seed of *Ficus glomerata* is closely related to changes in fruit colour and moisture content of seeds, which indicate applicable timing of collection to avoid large scale losses in collecting non-viable seeds for multiplication of species on a large scale.

Key words: Edible fruit, Germination, Ficus glomerata, Seed size.

MIRNA DYSREGULATION AND THEIR ASSOCIATION WITH CYTOGENETICALLY NORMAL PEDIATRIC ACUTE MYELOID LEUKEMIA

<u>PANKAJ SHARMA</u>¹, VIKAS GAUR^{1,2}, SHILPI CHAUDHARY², ANUDISHI TYAGI², SUYASH AGARWAL^{3,4}, HARPREET SINGH^{3,4}, SAMEER BAKHSHI², SACHIN KUMAR²

¹AMITY INSTITUTE OF BIOTECHNOLOGY, AMITY UNIVERSITY UTTAR PRADESH, NOIDA, INDIA

²DEPARTMENT OF MEDICAL ONCOLOGY, DR. B. R. A. INSTITUTE ROTARY CANCER HOSPITAL, ALL INDIA INSTITUTE OF MEDICAL SCIENCES, NEW DELHI, INDIA

³ICMR COMPUTATIONAL GENOMICS CENTRE, INDIAN COUNCIL OF MEDICAL RESEARCH, NEW DELHI, INDIA ⁴INFORMATICS, SYSTEMS AND RESEARCH MANAGEMENT, INDIAN COUNCIL OF MEDICAL RESEARCH, NEW DELHI, INDIA

Dysregulation of various miRNAs has been linked to the initiation and progression of several cancers including Acute Myeloid Leukemia (AML). However, their role in pediatric cytogenetically normal AML (CN-AML) is still unclear. The objective of the present study was to identify changes in miRNA expression levels and their association with survival outcomes. For this prospective study, bone marrow from 40 pediatric CN-AML patients and 27 controls were collected. Global miRNA profiling was done using small RNA sequencing of 10 samples (5 CN-AML and 5 controls) to identify differentially expressed miRNAs. The expression of 11 differentially expressed miRNAs was further analyzed in 40 CN-AML patients and 27 controls using TaqMan advanced miRNA assay. We also predicted targets of these 11 miRNAs and checked their expression by qRT-PCR. Global miRNA profiling revealed differential expression of 168 miRNAs (66 upregulated and 102 downregulated, p≤0.05). Out of 11 miRNAs selected for validation, we found 9 differentially expressed miRNAs i.e. upregulation of miR-1275, miR-196b, miR-4446-3p, miR-335-3p, miR-100-5p and downregulation of miR-409-3p, miR-151a-3p, miR-4772-5p and miR-758-3p. Lower miR-758-3p expression was associated with poor EFS and DFS while higher miR-4446-3p expression was associated with good EFS, DFS and OS Except PAX-5, the expression of most of the predicted targets of miRNAs were upregulated in pediatric CN-AML patients. Several miRNAs are differentially expressed and carry prognostic

significance in pediatric CN-AML patients. It would be interesting to know their functional relevance in the initiation and progression of leukemogenesis.

Keywords: Acute myeloid leukemia, MicroRNA, Survival, Expression

SELECTION INDICES FOR SHOOT FLY TOLERANCE IN SORGHUM (*SORGHUM BICOLOR* (L.) MOENCH) A.W. MORE, SYED ASGAR, J.E. JAHAGIRDAR AND R.R. DHUTMAL

1. DEPART. OF AGRIL., BOTANY, VASANTRAO NAIK MARATHWADA KRISHI VIDYAPEETH, PARBHANI (MS) 2. SORGHUM RESEARCH STATION, VASANTRAO NAIK MARATHWADA KRISHI VIDYAPEETH, PARBHANI (MS)

Sorghum shoot fly (Atherigona soccata Rond.) one of the major constraints in sorghum production and host plant resistant is one of the component to control to sorghum shoot fly. The present study was carried out with hundred and sixteen Sorghum germplasm lines and four checks one resistant check, one susceptible check and two varietal checks. Observation were recorded on the characters viz., deadheart percentage, trichome density, leaf glossiness, seedling vigour, leaf wetness, Plumule and leaf sheath pigmentation, chlorophyll content, plant height, leaf length, leaf breadth, leaf angle, days to 50% flowering, days to maturity, 100 seed weight and grain yield per plant. The data were collected and analyzed for correlation and path analysis. The characters leaf glossiness, seedling vigour, leaf wetness and chlorophyll content were significant and positively correlated with dead heart percentage at 28 DAE at both the genotypic and phenotypic levels. Whereas, trichome density (adaxial and abaxial), plant height, leaf length, leaf breadth and grain yield per plant has recorded negative significant association with dead heart percentage at 28 DAE at both genotypic level. While, 100 seed weight has significant but negative correlation with dead heart percentage at 28 DAE at genotypic level only.

Key words :- Correlation, Sorghum, shootfly, variability

CHARACTER ASSOCIATION AND PATH ANALYSIS FOR DROUGHT TOLERANCE IN POST RAINY SORGHUM (Sorghum bicolor (L). Moench)

A.W. MORE^{1*}, R.R. DHUTMAL², L.N. JAWALE² AND J.E. JAHAGIRDAR²

1. DEPART. OF AGRIL., BOTANY, VASANTRAO NAIK MARATHWADA KRISHI VIDYAPEETH, PARBHANI

2. SORGHUM RESEARCH STATION, VASANTRAO NAIK MARATHWADA KRISHI VIDYAPEETH, PARBHANI

The present study was conducted to assess correlation and path coefficient analysis for drought contributing traits and yield in 28 post rainy sorghum genotypes (Sorghum bicolor (L). Moench). These 28 genotypes along with two checks (B-35 and CSV-23) were grown at Sorghum Research Station, Vasantrao Naik Marathwada Agricultural University, Parbhani during rabi 2016-17 in randomized block design with three replications. The agronomic and plant protection measures were followed as and when required during the period of crop growth. Observations were recorded on five randomly selected plants in each entry from each replication. Significant and positive association with grain yield per plant (g) was exhibited by total 13 traits viz., plant height, panicle dry weight and total biomass at 50% flowering, leaf dry weight and panicle dry weight at maturity (g), total biomass at maturity, harvest index, grain number per panicle, 1000 grain weight, leaf area (cm) and leaf area index at flowering both at genotypic and phenotypic level. Days to 50 per cent flowering and days to physiological maturity showed negative and significant correlation with grain yield per plant suggesting late maturing genotypes accumulates more dry matter for maximum expression of these characters. Chlorophyll content at flowering had significantly positive correlation with leaf area and leaf area index while traits relative water content, chlorophyll content, stay green trait and stomatal index had non-significant correlation with grain yield per plant. Traits days to physiological maturity, total biomass at maturity, dry stover yield at maturity, grain number per panicle, 1000 grain weight and leaf area index at flowering had positive direct effect on grain yield. Significantly positive correlation for these traits explains its true relationship and selection for the character will be effective. Indirect positive effect of total biomass and dry stover yield at maturity was observed via panicle dry weight, dry stover yield at maturity, 100 seed weight, leaf area at 50% flowering and leaf area index.

Key words: correlation, path analysis, drought, post rainy sorghum

CHANGING PATTERN OF LAND USE AND ITS IMPACT ON AGRICULTURE IN PAURI GARHWAL

HARIMOHAN BHANDARI¹ & DR. MAMTA MISHRA²

¹DEPT. OF GEOGRAPHY, M. B. GOVT. PG. COLLEGE HALDWANI, NAINITAL.

²DEPT. OF GEOGRAPHY, M. B. GOVT. PG. COLLEGE HALDWANI, NAINITAL.

Due to alterations in physiographic and socio-economic conditions, climatic changes, adaptation, and declining growth of population, the land-use pattern of Pauri Garhwal is changing very rapidly. Hence, an attempt has been made in this paper; a study has been taken up for Pauri Garhwal District of Uttarakhand. This is to understand the change in the Land use pattern of the study area. The time-series data i.e. 2009-10 and 2015-16 has been acquired from secondary sources. Pauri Garhwal district spread over an area of 5,329 sq. km and ranks 5th in terms of population in Uttarakhand. After the completion of this study, we found that there was a change in every single category of land use except forest cover in the study area. It was also observed that the agricultural land of the study area is losing rapidly and the area of barren land is increasing year by year. If this rate continues, the agricultural land will be totally eliminated within the next years. In this paper, the change in land use has been shown on the block level while the trend of land use has been shown on the district level. **Keywords**: Land Use Change, Forest, Agricultural Land, Barren Land, Trends.

ISOLATION AND ANTIBIOGRAM OF NON FERMENTING GRAM NEGATIVE BACILLI IN DIFFERENT CLINICAL SAMPLES.

1*NEHA CHAUHAN, ²CHHAYA SINGH, ³VAISHALI AGGARWAL, ³VAISHALI CHOPRA

1*DEPARTMENT OF MICROBIOLOGY, SGRR SCHOOL OF PARAMEDICAL SCIENCES, SGRRU, DEHRADUN.

² GOVT. DEGREE COLLEGE, THALLISAIN, PAURI GARHWAL.

³ DEPARTMENT OF LIFE SCIENCES, GRAPHIC ERA UNIVERSITY, DEHRADUN.

Non-fermenting gram negative bacilli (NFGNB) are taxonomically diverse group of pathogens that has emerged as a major cause of health care associated infections especially in immunocompromised hosts. Identification of NFGNB and monitoring their susceptibility pattern are important for proper management of infections caused by them. Prevalence and antibiogram of NFGNB has not yet been reported from this

part of India. Aim of the present study was to characterize the prevalence of NFGNB along with their antimicrobial sensitivity pattern among the patients coming to the selected hospital. A total of 1675 various clinical specimens were received in laboratory and were processed. Non fermenters were identified using a standard protocol. Antimicrobial susceptibility testing was performed by Kirby Bauer disc diffusion method. Out of the 1675 clinical samples NFGNB were considerably yielded. *Pseudomonas* species and *Acinetobacter* species were the most commonly isolated NFGNB. A high level of antibiotic resistance was recorded for most of the first and second line drugs. Imipenem and amikacin were the drugs with maximum activity. Identification of NFGNB and monitoring their susceptibility patterns will help in proper management of infections caused by them. Improved antibiotic stewardship and infection-control measures will be needed to prevent or slow the emergence and spread of multidrug-resistant NFGNB in the healthcare setting. **Key words:** *Acinetobacter*, antibiotics, nonfermenters, nosocomial infection, *Pseudomonas*

ADVANCES IN DEHYDRATION OF FRUITS AND VEGETABLES

VIVEK MEHTA^{*1}, DEVINA VAIDYA¹, HAMID¹, SUNAKSHI GAUTAM¹ AND POOJA SONI¹ ¹DEPARTMENT OF FOOD SCIENCE AND TECHNOLOGY, DR YASHWANT SINGH PARMAR UNIVERSITY OF HORTICULTURE AND FORESTRY, NAUNI, SOLAN, HIMACHAL PRADESH 173230, INDIA

Drying is among the most ancient and pre-eminent physical methods of food preservation that aims at lowering the moisture content to a safe limit which prevent microbial growth and spoilage in cereals, grains, fruits, vegetables, spices and other products. According to FSSAI (2011) the dehydrated finished product shall have safe moisture content not more than 20.0 per cent. Drying of food takes place by exposure to heat through different modes of heat transfer like convection, conduction and radiation. Various conventional methods used for dehydration have been evolved from simple use of solar energy to different drying methods like cabinet, tunnel, spray, drum and freeze drying as well as osmotic dehydration, as the end product suffers from poor quality and the probability of product contamination in conventional. The latest developed technologies include microwave, radiofrequency, ultrasound, refractance window, superheated steam and high electric field drying which exploit different physical phenomena to enhance already commercialized drying techniques. Novel drying techniques entail greater emphasis on improving the efficiency and efficacy of drying so that energy consumption can be reduced along with retention of nutrient quality of food. An unsuitable drying process can induce degradation (oxidation, loss of colour, loss of nutritional-functional properties) and structural changes in the food (shrinkage, loss of texture). These physical and chemical changes can render the food products unacceptable to consumers. Therefore, development of novel drying technologies is important for dehydration of food and agro-products in countries like India where the cold chain and other storage facilities are not well established which would then help in the prevention of postharvest losses.

Keywords: Novel drying techniques (microwaves, radiofrequency, ultrasounds, refractance window)

MANAGEMENT OF FRUIT ROT OF "BHUT JOLOKIA" (*CAPSICUM CHINENSE* JAQC.) CAUSED BY *COLLETOTRICHUM GLOEOSPORIOIDES* WITH BIOLOGICAL APPROACHES

DAISY SENAPOTY*, GYANASHREE DAS, SUNITA DUTTA** AND PRANAB DUTTA

DEPARTMENT OF PLANT PATHOLOGY, ASSAM AGRICULTURAL UNIVERSITY, JORHAT-785013, ASSAM

Fruit rot of 'bhut jolokia' caused by *Colletotrichum gloeosporioides* is a very serious disease prevalent in North East India predominantly in the states of Assam, Nagaland and Manipur. The present investigation aimed at study the *in vitro* and *in vivo* efficacy of the disease bioagents and botanicals. Six bio-agents viz. *Trichoderma viride*, *T.harzianum*, *T. pseudokoningii*, *T. asperellum*, *Paecilomyces lilacinus* and *Pseudomonas fluorescens* were tested against *C. gloeosporioides*. Out of these, *T. viride* was found to be most effective followed by *T. harzianum* and *T. pseudokoningii* respectively. Twelve botanicals were evaluated at 50 percent concentration *in-vitro* for their efficacy against *C. gloeosporioides* by 'poisoned food technique'. Amongst the botanicals, *Allium sativum* showed highest inhibition of mycelial growth followed by *Acorus calamus* and *Azadirachta indica*. These three botanicals were further tested against *C. gloeosporioides* at three different concentrations viz., 5 %, 10% and 15% respectively. Amongst these 15 % concentration was found superior to others. Based on *in-vitro* tests, three effective bio-agents and botanicals were tested against the disease in pot condition. Results showed that seed treatment and foliar spray of *A. sativum* was found to be most effective, showing lowest disease incidence (7.35%) and percent disease index (7.49). This was followed by seed treatment and foliar spray of *A. calamus*. Among the bio-agents, seed treatment and foliar spray with *T. viride* showed lowest disease incidence (17.24%) and percent disease index (17.56) compared to other bio-agents. Highest yield (113 g/plant) was recorded in seed treatment and foliar spray with *A. sativum* followed by seed treatment and foliar spray with *A. calamus* (95 g/plant). On the other hand, lowest yield was recorded in control (30 g/plant). Spraying with plant extracts and antagonistic micro organisms were effective against *C. gloeosporioides*, but all these ranked behind the chemica

Keywords: Biological management, bhut jolokia, biocontrol agents, botanicals, Colletotrichum gloeosporioides

TECOMELLA UNDULATA (ROHIDA): A VALUABLE TREE OF THE DESERT

VIJAY_DANEVA1, R.S. BENIWAL1 AND KAJAL1

¹DEPARTMENT OF FORESTRY, CCS HARYANA AGRICULTURAL UNIVERISTY, HISAR, HARYANA-125004, INDIA

Tecomella undulata (Rohida) may become an important tree in arid and semi-arid areas for the production of high quality timber in addition to fuelwood and fodder. It occurs naturally in the desert areas of India, Pakistan and Arabia and is highly tolerant of drought conditions. It is nearly evergreen small tree with dropping branches and curved trunk. It attains height ranging from 4 to 8 m with circumference of trunk from 50 to 80 cm and is extremely slow growing with deep root system. It is a medium sized tree that produces quality timber and is the main source of timber amongst the indigenous tree species of desert regions of Shekhawati and Marwar in Rajasthan with the result its trade name is 'Desert teak' or 'Marwar teak'. Rohida grows successfully in arid regions with 250-400 mm annual rainfall and found growing naturally in small patches. It is a tree that plays vital role as grown in undulated lands have low tree cover and multiple use and of its multiple uses. It is one of the best timber species of the world. Its timber values high for furniture, building constructions and other uses. The wood is hard, strong, seasons well and decay resistant. It is suitable for furniture industry and

has good demand. It has got medicinal properties as well. It enriches the soil as the population of soil micro-organism is also found to be high under the canopy of this tree. Soil physio-chemical investigations revealed generally high nitrogen, phosphorus and potassium levels beneath the canopy and increased soil fertility status with respect to organic carbon, total nitrogen, phosphorus and available macro and micro-nutrients. It is a deciduous or nearly evergreen small tree native of desert region of India. Generally Rohida is propagated by seeds. However, the seed viability declines with the time and decline to zero after one year of harvest.

Keywords: Tecomella undulata, Desert, Timber tree and Soil improver

ESTIMATION OF VARIABILITY FOR VARIOUS TRAITS IN SESAME (SESAMUM INDICUM L.) PARAS¹, VLIAY DANEVA², SUMAN DEVI¹ AND RK SHEORAN¹ ¹DEPARTMENT OF GENETICS AND PLANT BREEDING, CCS HARYANA AGRICULTURAL UNIVERSITY ²DEPARTMENT OF FORESTRY, CCS HARYANA AGRICULTURAL UNIVERSITY

Sesame (Sesamum indicum L.) is one of the oldest oilseed crops in the world known to humans and is valued for its high quality seed oil. It belongs to the genus Sesamum of the family Pedaliaceae, includes 38 species and most of them are wild. Evaluation of genetic variability is necessary not only in selecting elite parents of high yielding but also for utilizing disease and pest resistant varieties in breeding programme. The present research was conducted randomized block design with 60 sesame genotypes in three replications during kharif season 2017 at experimental area of Oilseeds Section, Department of Genetics and Plant Breeding, CCS Haryana Agricultural University. The observations were taken for twelve characters including days to 50% flowering, days to maturity, plant height (cm), number of primary branches per plant, number of secondary branches per plant, number of capsules per plant, number of seeds per capsule, capsule length (mm), capsule width (mm), 1000-seed weight (g), Oil content (%) and seed yield per plant (g). Analysis of variance revealed significant differences among the genotypes for all the characters, indicating a wide range of variability useful for further selection and improvement. Highly significant mean sum of squares due to genotypes for all the morphological characters indicated the presence of substantial genetic variability among the genotypes under study. Phenotypic coefficient of variation (PCV) was found to be greater than the genotypic coefficient of variation (GCV) for all the twelve characters studied, which reflected the role of environment in the expression of the observed traits. In the present study, Highest values of PCV and GCV were observed for number primary and secondary branches per plant, number of capsules per plant, number of seeds per capsule and seed yield per plant. These results suggested that there is considerable possibility of further improvement for these characters through hybridization.

Key words: Sesame, variability, PCV, GCV

MECHANISMS FOR MITIGATION OF COMBINED EFFECT OF DROUGHT AND HEAT STRESS IN WHEAT SUMAN DEVI¹, VIKRAM SINGH¹, RAKESH KUMAR¹ AND R. N. SHEOKAND² ¹DEPARTMENT OF GENETICS & PLANT BREEDING, CCS HARYANA AGRICULTURAL UNIVERSITY, HISAR-125004 ²COMPUTER SECTION, COLLEGE OF BASIC SCIENCE & HUMANITY, CCSHAU, HISAR-125004

Response of a plant to a combination of different abiotic stresses is unique and cannot be directly extrapolated from simply studying different stresses individually. Combined effect of water deficit and extreme temperatures are especially considered as key stress factors with high potential impact on crop yield. Tolerance of these abiotic stresses is a complex phenomenon, comprising a number of physicobiochemical alterations at cellular and whole organism levels. Several mechanisms like stem reserve mobilization, increasing water uptake by developing large and deep root system, reduction in water evaporation by increasing stomatal resistance and accumulation of osmolytes. Stem reserves contribute 20 to 40% weight of the grain in non-stressed condition and this can be up to 70% under stressed conditions during grain filling. Osmoprotectants such as amino-acid (proline, glycine-betaine and glutamate) and sugars (mannitol, sorbitol and trehalose) have a key role in maintaining membrane integrity and prevent the enzyme inactivation under stressful environment. One of the extensive cellular events occurred during drought and heat stress is the activation of cascades of molecular network in stress perception, signal transduction and modification of gene expression resulting in a strict control of all plant responses towards the stress. Further, elucidating the function of ion transporters, proteins, osmolytes, antioxidants and other factors expressed in stress conditions may provide paramount information for designing the new strategies for crop improvement. Keywords: Drought, Heat stress, Physic-biochemical, Osmolytes

SHOOT TIP GRAFTING IN CITRUS SPECIES

PRAGATI¹, ANIL K. GODARA² AND REETIKA³ DEPARTMENT OF HORTICULTURE (FRUIT SCIENCE), MAHARANA PARTAP HORTICULTURAL UNIVERSITY, KARNAL

^{2,3} DEPARTMENT OF HORTICULTURE, CCSHAU, HISAR

Citrus is one of the world's most economically important fruit crops and belongs to family Rutaceae. It is the third most cultivated fruit crop in the world after mango and banana. Conventionally, plants are propagated through budding but virus can easily transmit through budding. There are 16 types of viruses reported which are transmittable through budding. Viral infection transmitted through budding has been reported to be the major cause of citrus decline at various locations in India. Viral diseases transmitted during vegetative propagation are Greening, Tristeza, Psorosis, Xyloporosis, Exocortis, Leprosis, Zonate chlorosis, Yellow ring spot, Crinkly leaf, Leaf curl, Infectious variegation, Satsuma dwarf etc. Due to the problem of Citrus decline, recently the average production of India is gradually decreasing. Due to diseased planting material, there is a need to develop an alternate method of propagation. Therefore, Meristem Culture and Shoot tip grafting or Micro-grafting technique can be used for the mass production of true-to-type, disease free quality planting material of citrus. Shoot tip grafting is an *in-vitro* grafting technique which involves the placement of a meristem or shoots tip explant onto a decapitated rootstock that has been grown aseptically from seed or micro propagated cultures. The rootstocks have major effect on growth, fruit quality and longevity of the tree as well as influence the susceptibility of the trees to various insect- pest and diseases. The procedure will be very useful for further production of disease free budwood stock.

Keywords: Budding, Citrus decline, Meristem culture, micro-grafting, Susceptibility, Budwood

EFFECT OF DIFFERENT SPACINGS OF POPLAR ON GROWTH AND PRODUCTION OF FODDER SORGHUM

*SNEH YADAV AND R. S. DHILLON

DEPARTMENT OF FORESTRY, CCSHAU, HISAR- 125004

The present investigation was conducted at research area of Forestry Department, CCS Haryana Agricultural University, Hisar during *kharif* season of 2018-19 to study the effect of different spacings (3×3 m, 4×3 m, 5×3 m, 6×3 m, 7×3 m and 8×3 m) of poplar on production of fodder sorghum. The highest plant population (29.21) of sorghum was recorded under in 8×3 m followed by 7×3 m (26.52), 6×3 m (23.30), 5×3 m (22.13), 4×3 m (19.79) and least (17.31) under 3×3 m spacing. The plant population in sole sorghum (control) was found higher (31.43) than under different spacings of poplar. Plant height of sorghum at different days after sowing (DAS) was observed significantly higher (256.89 cm) in 8×3 m than different spacings of poplar. The number of tillers per meter square and leaf area index was recorded higher (64.26 and 6.40) under control (sole sorghum) over different spacings of poplar. However, maximum number of tillers per m² (59.03) and leaf area index (6.00) was found under 8×3 m spacing than other spacings. The reduction in fresh fodder yield of sorghum under 3×3 m, 4×3 m, 5×3 m, 6×3 m, 7×3 m and 8×3 m spacings of poplar was 44.03, 35.94, 20.72, 17.33, 12.42 and 11.34 per cent, respectively over control (devoid of trees).

Keywords: Poplar, sorghum, agroforestry, spacing, leaf area index.

IN VITRO INSECTICIDAL AND FUNGICIDAL ACTIVITIES OF ANAPHALIS BUSUA LEAVES

¹RAKESH RATURI, ¹A.M. PAINULY, ²S.C. SATI AND ³P. P. BADONI ¹DEPARTMENT OF CHEMISTRY, GOVT. (P.G.) COLLEGE, NEW TEHRI, TEHRI GARHWAL ²DEPARTMENT OF CHEMISTRY, HNB GARHWAL CENTRAL UNIVERSITY, SRINAGAR GARHWAL ³DEPARTMENT OF CHEMISTRY, B.G.R CAMPUS PAURI, PAURI GARHWAL

Anaphalis busua (Bugla) belongs to family *Asteraceae* is an eract tall herb. Stem usually branched from base, somewhat winged. Leaves sessile, linear lanceolate or oblanceolate most abundantly present in open places of oke and pine forests of submountain and mountain Himalayas. The aim of the present study was to investigate the insecticidal and fungicidal activities of *Anaphalis busua* whole plant. The ethanolic extract of *Anaphalis busua* was tested for its insecticidal activity against mustard aphid *Lipaphis erysimi* under *in vitro* condition. The insect mortality percentage was found to be increase with the corresponding increase in dosage indicating a direct relationship between the two. The natural insecticides (ethanolic plant extract) was found very effective and caused 24%, 40%, 56% and 63% mortality after 24 hrs; 14%, 21%, 32%, 45% after 12 hrs and 3%, 14%, 16%, 19% after 6 hrs with the concentrations 0.50, 1.00, 1.50 and 2.0 mg/L respectively. The extract was also tested for its fungicidal activity against *Fusarium oxysporum*. The extract showed 6.50%, 7.00%, 7,5.00% and 10.00% growth inhabitation with the concentrations 2%, 5%, 10% and 20 % respectively. Thus, the present study revealed that the plant extract have a remarkable insecticidal and weak fungicidal activity.

Keywords: Anaphalis busua, Asteraceae, Lipaphis erysimi

EFFECTS OF CLIMATE CHANGE AND GLOBAL WARMING.

ACADEMY SUTNGA¹, DIVYA KHATRI², ABHISHEK ASWAL³

DEPARTMENT OF AGRONOMY, BANARAS HINDU UNIVERSITY, VARANASI, UTTAR PRADESH

Climate change has become one of the prime issues threatening the sustainability of world's environment. Today the biggest challenge of humanity is to protect the world's climate. Carbon dioxide contributes about 60% of total global warming, whereas methane 20%, CFCs 14% and N₂O 6%. The ecosystems most likely to be disrupted causes loss of biodiversity, extinction of species, loss of wildlife habitats, disappearance of forests, increases droughts and floods, rise in sea levels etc. Shifts in regional climate would also threaten many parks, wildlife reserves, forests, and wetlands. Weeds, insect pests and vectors like mosquitoes are likely to increase in warmer areas. Global mean surface air temperature (the earth's surface temperature) between 0.3° C -0.6°C especially during the latter half of 20th century. It is estimated that the global mean surface air temperature would increase 2°C by the year 2030 which may cause many damages to the planet. There will be a drastic change in weather patterns, bringing more floods or droughts in some areas that would spread diseases and reduce agricultural output; billions of people will be affected by problems of drinking water supply, sanitation and drought. Crop yields will fluctuate. Though overall global agricultural production may not change, there will be large regional difference. Tropics and subtropics may face problem of decreased food production. Negative impacts will be more on developing countries of semi-arid zones. Hence, the influence of human activities on the climate is clear and growing. If left unchecked, climate change and global warming will have an irreversible impact on people and ecosystem.

Keywords- Biodiversity, Crop, Ecosystem, Habitat.

IMPORTANT STRATEGY FOR DOUBLING THE FARMER'S INCOME.

ANSHUL SINGH¹, ANKIT YADAV¹, SATYAVEER SINGH²

¹DEPARTMENT OF SOIL SCIENCE AND AGRICULTURAL CHEMISTRY, ²DEPARTMENT OF AGRONOMY C. S. A. UNIVERSITY OF AGRICULTURE &TECHNOLOGY, KANPUR UTTAR PRADESH.

Doubling farmer's income is quite challenging but it needed and attainable. Three-pronged strategy: 'focused on development initiatives, technology and policy reforms in agriculture' is needed to double farmer's income. Farming in India is characterized by small, marginal, & fragmented land holdings (about 86 per cent) and is highly depended on monsoon showers. Operating small holdings is often unviable and, in this situation, farming is not a profitable business or enterprise. A considerable scope exists to increase the income of farmers by adopting agroforestry, rural based low cost primary processing for value addition, cool chain and by adopting secondary and specialty agriculture such as: protected cultivation, mushroom production, bee keeping, sericulture, growing low volume high value crops like nuts, spices, medicinal plants, seed production of vegetable hybrids, nursery raising to provide disease free saplings, fish seed production, growing of flowers, post-harvest processing, etc. Therefore, there is an urgent need of transformation in agriculture production combined

with integrated farming system (IFS) approaches that involves crop cultivation, dairy, poultry, fishery, agro-forestry, piggery, beekeeping, vegetable and fruit production, use of renewable energy source (*i.e.* Solar energy, Biogas) etc. For doubling of the farmer's income few vital strategies need to be adopted considering the basic requirements of the farmers. These strategies might be massive investments in agricultural research and development, adoption of Good Agricultural Practices (GAP), conservation agriculture, implementation of farmers friendly policies, judicious use of available resources and inputs, along with improved market and transportation facility, minimum support price (MSP) reform, supported by adequate and timely availability of bank credits. **Keywords**- Farmers, crop, income.

ASSESSMENT OF CHEMICAL COMPOSITION OF BARLEY FLOUR AND LIQUID WHEY AND THEIR UTILIZATION IN THE PREPARATION OF BUNS

ANKITA DOBHAL¹, PRATIMA AWASTHI²

DEPARTMENT OF FOODS AND NUTRITION, COLLEGE OF HOME SCIENCE, GBPUAT, PANTNAGAR, US NAGAR, UTTARAKHAND, INDIA.

Barley outperforms other cereals under various environmental stresses due to its winter-hardy, drought-resistant, and early maturing nature and is more economical to cultivate. It is an excellent source of fiber, which helps lower the total amount of cholesterol and glucose in the blood, thereby decreasing the risk of heart disease. The by-product of cheese-producing industries, cheese whey, is considered as an environmental pollutant due to its high BOD and COD concentrations. However, whey protein is a rich source of bioactive peptides which may play a role in the dietary management of chronic diseases. Barley flour and liquid whey can be incorporated into various processed food products to enhance their nutritional and functional value and thus can contribute to food security and nutrition. The study was aimed to assess the chemical composition of barley flour and liquid whey and to utilise them in the preparation of buns. Nutritional evaluation showed that moisture (%), total ash (%), crude protein (%), crude fat (%), crude fibre (%), carbohydrate (%) and physiological energy (Kcal) content of barley flour was 12.30, 1.94, 12.86, 4.45, 10.01, 58.44 and 325.25 respectively. Mineral estimation (mg/100g) showed values for calcium and iron as 30.53 and 2.97 respectively. Chemical composition of liquid whey revealed total solids (mg/l), lactose (%), protein (%) and pH as 5.8, 4.5, 0.60 and 5.1 respectively. Buns were prepared using the method given by Pyler (1988). Liquid whey was concentrated and used as a substitute of water for dough preparation with 50 per cent evaporation. Barley flour was incorporated with wheat flour in ratios 00:100, 20:80, 40:60 and 60:40. Sensory evaluation was done using Nine-Point Hedonic Scale and Score Card Method by 15 semi-trained panel members. There was no significant difference in the overall acceptability scores of control buns and 40 per cent barley flour incorporated buns. Therefore, barley flour and otherwise considered waste from cheese processing industry i.e. liquid whey can be used in the preparation of buns without affecting its quality adversely.

Keywords: Barley Flour, Liquid Whey, Chemical Composition, Buns, Sensory Evaluation

SOIL CHARACTERISTIC DIFFERENCES ACROSS THREE ALPINE MEADOW SITES DIFFERING IN MAGNITUDE OF GRAZING PRESSURE

PARDEEP KUMAR SHARMA*¹, NARENDRA SINGH LOTANI*, PRIYA BISHT*

*ECOLOGY AND BIODIVERSITY LAB., DEPARTMENT OF ZOOLOGY, M.B. GOVERNMENT POSTGRADUATE COLLEGE, HALDWANI (NAINITAL) – 263139.

The alpine meadows of the Western Himalaya remain important habitats of many forms of organisms. *Ophiocordyceps sinensis* locally referred to as 'keera ghaas' or 'Yartsa Gunbu' is one of the important caterpillar fungi, which inhabit the alpine meadows, between 3200 to 4700meter amsl. The anthropogenic pressure exacerbated by grazing pressure of the livestock population influence the soil physical as well as chemical properties, which impinge upon the lifecycle of the host larva, i.e. *Thitarode spp.* The present study is an effort to determine the effect of the livestock grazing pressure on the soil chemical and physical properties. Three different study sites differing in magnitude of the grazing pressure were selected- (i) Balmiya top- experiencing maximum grazing pressure, (ii) Rukhiyan- with moderate grazing pressure and (iii) Janthri- experiencing least or no grazing pressure. The results of the preliminary study show that while soil texture in all the three sites remain more or less same; the other parameters studied, i.e. water holding capacity, moisture content, total Nitrogen and organic carbon percentage vary in different sites, for example, the percentage of total nitrogen and organic carbon is higher in Balmiya top followed by Rukhiyan and Janthri. The preliminary results are encouraging, as they depict the salient impact of grazing pressure on the soil physical and chemical properties.

Key words: Alpine meadows, grazing pressure, total nitrogen, organic carbon and soil texture

MACROFUNGAL AND ASSOCIATED MACRO ARTHROPOD DIVERSITY AND SOIL NUTRIENT DYNAMICS IN A TEMPERATE FOREST, WESTERN HIMALAYA

PRIYA BISHT*¹, PARDEEP SHARMA*, NARENDRA SINGH LOTANI*

*ECOLOGY AND BIODIVERSITY LAB., DEPARTMENT OF ZOOLOGY, M.B. GOVERNMENT POSTGRADUATE COLLEGE, HALDWANI (NAINITAL)- 263139.

The present study relates to the association between the macrofungi and the macroarthropod species vis-à-vis the role played by the group in the nutrient cycling. The very basis of the study remains the fact that (i) in habitat sites devoid of earthworm species (presumably, though), the all-encompassing nutrient cycling could be ascribed to the arthropod fauna, with additional supplementary, and very often mutualistic role played by the fungi in making available the nutrients to the above-ground vegetation; and that (ii) arthropod faunal diversity show a progressive change with the 'stage of growth' of the mushroom species. For the study, we have selected an old wood forest, dominated by *Abies pindrow* in Darma valley, Western Himalaya. The study site, as would be expected exhibits a rich diversity of mushrooms, with a number of species, in fact being harvested by the locals. The study site was divided into two sub-segments, and designated as disturbed (A) and undisturbed (B), based on the extent of the anthropogenic pressure, habitat fragmentation, etc. Care was taken that all other topographical features, as well as dominance of *Abies pindrow* was taken into account. For the ease of study, only macro-arthropods diversity and above-ground macro-fungi are being studied. However, as relates to the associationship, we have restricted the study to only 8-10 species of edible mushroom, preferably harvested by the locals, with an aim to quantify the harvested lot of the mushroom and correlate the same with changes in the nutrient status of the habitat soil.

The preliminary study, restricted to a single visit in the month of September show the presence of 90 species of macro-fungi and 28 species of macro-arthropods. The later dominated by coleopterans followed by dipterans. The salient aspect of the soil nutrient analysis of the two sub-sites (A and B) are the following- (i) total phosphorus and total organic carbon (TOC) content remains more of less the same, with values of- phosphorus 0.06 and 0.07% and TOC- 14.1 and 13.89%, respectively, while average pH in A segment is slightly lower (pH-5.83) as compared to pH- 6.17 in segment B. Of significance is the fact that both available and total nitrogen in forest segment A (disturbed) is conspicuously less than in forest segment B (undisturbed) with values of 68.75 and 71.07 kg/hac, and 0.47 and 0.63 g/kg, respectively). Soil is predominantly sandy-loam.

Keywords: - Biodiversity, macro-arthropods, macro-fungi, nutrient cycling

DISTRIBUTION AND ABUNDANCE OF MOTH DIVERSITY ACROSS ALTITUDINAL GRADIENT, WESTERN HIMALAYA, UTTARAKHAND

NARENDRA SINGH LOTANI*¹, PRIYA BISHT*, PARDEEP SHARMA*

*ECOLOGY AND BIODIVERSITY LAB., DEPARTMENT OF ZOOLOGY, M.B. GOVERNMENT POSTGRADUATE COLLEGE, HALDWANI (NAINITAL)- 263139.

Moths remain vital to terrestrial ecosystems as major herbivores, pollinators, as well as for their role in nutrient cycling. Unfortunately, their natural populations are negatively affected by degradation of their habitats, mostly due to anthropogenic activities. Moths have been established as an indicator species that reflects upon the effect of forest fragmentation, land-use pattern, deforestation and regeneration. Elevational gradients may be one of the few ways to study the effects of say, climate change on ecological communities and forested elevational gradients representing sets of adjacent micro-climate are excellent tools for such studies. The present study site thus is divided across the altitudinal gradient into 3 transects differing in altitude of 1000 meters each- the lower zone (1000-2000 m) characterized by montane moist temperate type of forest, mid-altitude zone (2000-3000 m), characterized by temperate and sub-alpine type of forest, and lastly the higher altitude zone (3000-4000 m), characterized by alpine vegetation. Each transect, was further grouped into sets of five plots at each of the five elevational bands separated by vertical intervals of approximately 200 m. Automated light traps for used for insect collection. Our preliminary collections spread over a duration of 4 months (mid-May to Mid-September) yielded 162 species of moths, encompassing 15 families, 38 sub-families, 122 genera; dominated by Geometridae (38 genera and 55 species), followed by Erebidae (32 genera and 44 species), Noctuidae (17 genera and 20 species), Notodontidae and Drepanidae (9 species each), Crambidae and Lasiocampidae (8 and 6 species, respectively), Saturniidae, Sphingidae and Endromidae (2 species, each), while Eupterotidae, Cossidae, Limacodidae, Nolidae and Bombycidae, represented by single species, each.

Keywords: Altitudinal gradient, Biodiversity, indicator species, moth assemblage

GENETIC DIVERGENCE IN AROMATIC RICE GENOTYPE BASED ON QUANTITATIVE CHARACTER NIDHI KUJUR, DR. SANDEEP BHANDARKAR AND DR. S.K. NAIR

DEPARTMENT OF GENETICS AND PLANT BREEDING, INDIRA GANDHI KRISHI VISHWAVIDYALAYA, RAIPUR

The present investigation entitled "study of genetic divergence in aromatic rice genotype based on quantitative character" was carried out with the 47 genotypes which were grouped into five clusters for quantitative traits. In quantitative characters, there were fifteen genotypes in clusters I, five in cluster II, eleven in cluster III, nine in cluster IV and seven in cluster V. The maximum intra cluster distance was shown by cluster IV and maximum inter cluster distance was found between cluster II and cluster V. Selection of genetically diverse parent is important to get wide range of recombinants.

Key words: Aromatic rice, genetic divergence, quantitative characters, cluster analysis.

DEVELOPMENT AND UTILIZATION OF VALUE ADDED BISCUITS BASED FROM PEARL MILLET INCORPORATING CARROT LEAVES POWDER

RAJNI AND ASHA KAWATRA

FOODS AND NUTRITION DEPARTMENT, I.C. COLLEGE OF HOME SCIENCE, CCS HAU, HISAR(HARYANA)

Pearl millet (Pennisitum glaucum) is one of the most widely grown among all type of millet and it is extensively distributed across the semiarid tropics of Africa and India. Pearl millet is a rich source of macronutrients and micronutrients i.e. calories, proteins, vitamins and minerals; hence they are termed as "nutri-cereals". Carrot leaves are very rich in nutrients such as protein, vitamin C, β-carotene, fibers and several minerals such as Na, P, K, Ca, Mg, Mn, Zn and Fe. To improve the shelf life of pearl millet flour as well as processed products reduction of anti-nutritional factors is necessary which could be achieved by using numerous processing techniques for instance dehulling, milling, malting, blanching, parboiling, acid and heat treatments. The present investigation was carried out to develop value added product biscuits from (biofortified variety HHB-299) pearl millet incorporating carrot leaves powder and to evaluate them for organoleptic acceptability and nutritional composition. Four types of biscuits were prepared using pearl millet incorporating carrot leaves powder at 5%, 10%, 15% and 20% levels and were found to be organoleptically acceptable on the basis of nine point hedonic scale. Mean acceptability scores for colour, appearance, aroma, texture, taste and overall acceptability of biscuits at 5, 10 and 15% level fell under 'moderately liked' category whereas biscuits incorporating 20% of carrot leaves powder fell under the category of 'liked slightly' as adjudged by panelists. Control biscuits had highest mean acceptability scores for all sensory attributes and fell in the category of 'liked very much'. Incorporation of carrot leaves powder improved the nutritional composition of four types of developed value added biscuits. Every increment in addition of carrot leaves powder in pearl millet product lead to proportional increase in level of crude protein, ash, crude fibre, calcium, iron and zinc content. The highest nutrient contents were found in Type-IV biscuits which were supplemented with 20 per cent carrot leaves powder as compare to control counterparts. The developed value added product were organoleptically acceptable and nutrient dense. . Incorporation of carrot leaves powder in daily recipies is an easily sustainable method can also be used as an alternate for the therapeutic supplements. These could be efficiently used as means of improving nutritional status of the community by popularizing and making them reach the masses to eliminate the malnutrition and can help to improve iron and Vitamin A status. Therefore, it can be concluded that

incorporation of carrot leaves powder in biscuits up to 20% along with pearl millet flour not only improves the texture, taste and overall acceptability but also improves the nutritive value of these products without adding much to the cost of the product and carrot leaves, which are generally thrown away can be utilized in a better way, thus reducing wastage.

Keywords:- Pearl millet, carrot leaves powder, biscuits, nutritional composition, organoleptic acceptability

GENETIC DIVERSITY ANALYSIS AND MOLECULAR CHARACTERIZATION OF RUST RESISTANCE IN WHEAT GERMPLASM.

NIDHI BHATT¹, J.P JAISWAL² AND RANJIT SAROJ³

^{1,2} DEPARTMENT OF SOIL SCIENCE, COLLEGE OF AGRICULTURE, G.B. PANT UNIVERSITY OF AGRICULTURE AND TECHNOLOGY, PANTNAGAR, U.S NAGAR, UTTARAKHAND, 263 145

³ DEPARTMENT OF GENETICS, INDIAN AGRICULTURAL RESEARCH INSTITUTE, PUSA CAMPUS, NEW DELHI

Wheat a cereal grass of the family Graminae (Poaceae) and genus *Triticum* is the world's largest cereal crop and also the most important food grain crop. However disease is one of the major factors which restrict the increment in the productivity of wheat. Rusts are among the most important fungal diseases of wheat worldwide. Considering the above point, the present investigation was carried out at N. E. Borlaug Crop Research Centre of G.B.P.U.AT, Pantnagar, Uttarakhand, India, in 2016-17 with 404 genotypes (400 entries and 4 checks). Results showed that quantitative characters played an important role in crop diversity and the characters grain yield/plot and 1000 grain weight, no. of grain/spike contributed maximum towards genetic diversity. Based on non-Hierarchical cluster analysis, the 404 genotypes including checks were grouped into 15 clusters. Cluster VIII and XV have the most desirable genotypes as it exhibited highest cluster mean values for majority of the characters under study. Based on inter-cluster distance, cluster mean values and per se performance, the potential parental combinations that could be considered for enhancing the overall yield levels in wheat were, IC2967743, IC296743, IC121129, IC539315, IC528964, IC532001, IC542052, EC574859. The highest LSD as CM, AVSB, AVDB, and AVAC were found for grain yield/plot. Negative correlation was found between grain yield/plot and A value. Based on the field screening, all genotypes were classified in three different categories i.e., resistance, intermediate and susceptible. Molecular analysis using linked SSR primers *Xpsp3000* and *Wmc221* and one STS marker *csLV34* of 83 accessions revealed the presence of *Yr10, Lr19, and Lr34/Yr18*. These 83 genotypes showed resistance response in the field under artificial inoculated conditions. So after further confirmation, these genotypes can be used as donor parents for above mentioned yellow and brown rust resistance genes.

EFFECTIVE ROLE OF THE ENTOMO-PATHOGENIC NEMATODES IN SUSTAINABLE BIOLOGICAL-CONTROL OF SOME IMPORTANT AGRICULTURAL PESTS:

OM DATTA,

DEPARTMENT OF ZOOLOGY, M.S. COLLEGE, SAHARANPUR, U.P., INDIA

In biological control an organism is used to reduce the population density of another organism and thus includes the control of animals, weeds and diseases. The organism which reduces the population of other organism is called the natural enemy. These natural enemies are called the biological control agents. Live organisms are used in bio-control. Entomopathogenic nematodes (EPNs) are the soil dwelling round worm, which are one of the important biological control agents, extensively being used to control the population of various economically important pests. So many experiments and surveys have been carried out all over the world to find and isolate the EPNs from soil, mass rearing and to study their efficacy against different economically important insect pests, and their important role in insect pests' management. The term "entomopathogenic" is taken from the Greek word *entomon* means insect and *pathogen* means disease causing. There are two genus of the EPNs *viz. Steinernema* and *Heterorhabditis*, which belongs to the family Steinernimatidae and Heterorhabditidae. The EPNs kill their host within 24, hrs, 48, hrs and maximum 72 hrs, as they have symbiotic bacteria in their gut which makes them different from other parasitic nematodes. The EPNs are very safe and eco-friendly to the environment, crops, soil, beneficial insects, and human being. They can be mass cultured in the laboratory easily and applied on the target pests. The EPNs kills only the harmful insects, not the beneficial. To avoid the use of hazardous chemical control, these entomopathogenic nematodes are the best and safe option. Different formulations of EPNs different pests are available in the markets all over the world. In the present paper the efficacy of different strains of EPNs against some important insect pests *i.g. Spodoptera litura, Helicoverpa armigera Pieris brsassicae*, Bihar hairy caterpillar, white grub etc. is being studied.

Keywords: Entomopathogenic nematodes, Spodoptera litura, Helicoverpa armigera Pieris brsassicae, Bihar hairy caterpillar, white grub, Steinernema, Heterorhabditis Biological control,

COMPARATIVE EVALUATION OF QUALITY CHARACTERISTICS OF MEAT PRODUCT OBTAINED FROM UTTARAFOWL, RHODE ISLAND RED AND THEIR CROSS

CHETANA PANT, PRANEETA SINGH*, NIDDHI ARORA AND K. P. SINGH.

DEPARTMENT OF LIVESTOCK PRODUCTS TECHNOLOGY, COLLEGE OF VETERINARY AND ANIMAL SCIENCES, GBPUAT, PANTNAGAR-263145, UTTARAKHAND

Native chicken breeds have high level of adaptability to home tract climate and show high resistance to prevalent endemic diseases and perform well without vaccination in the backyard system. A number of varieties of hill fowl are found in hilly areas that are different from the descript breeds. The local hill fowls of Uttarakhand particularly prevalent in the Kumaon region which is adjoining to Nepal and Tibet border are named as "Uttara fowl". The birds have crest or crown type structure on head and are locally known as Dotiyal murgi/ Bulbul murgi / Taj murgi. These birds thrive well under adverse climatic conditions such as poor feeding, housing and managemental conditions with variable temperature and humidity. The present study was envisaged to assess the potential of uttarafowl as a source of quality meat. The meat obtained from Uttarafowl (PB), Rhode Island Red (RIR) and their cross (UFxRIR) (CB) was converted into an enrobed and dry cooked product Breaded chicken chops. The product prepared from three groups was compared for different quality characteristics and texture profile analysis. The study revealed that marinade uptake, shrinkage% and cooking losses showed significantly (P<0.05) higher values for PB compared to RIR and CB and CB exhibited the values significantly (P<0.05) higher than RIR. Proximate composition of breaded chicken chops of RIR, CB and PB. Fat values for breaded chicken chops of PB showed the highest value followed by

RIR and CB. Non-significant differences existed between the protein values of CB and PB. PB showed significantly (P<0.05) higher values of ash compared to the other two breeds. Texture profile analysis of breaded chicken chops prepared from the meat of RIR, CB and PB showed significant (P<0.05) differences between the three breeds with respect to hardness, chewiness and adhesiveness with PB possessing the maximum hardness and adhesiveness while CB showed the maximum chewiness values. Sensory scores for all the attributes viz. colour and appearance, texture, flavor, juiciness and overall acceptability were significantly (P<0.05) higher for PB followed by CB and RIR. Based on above findings it can be concluded that Uttarafowl and their crosses possess all the potential to provide quality meat and serve as an alternative to broiler meat under minimal raising conditions.

Key words: Uttara fowl, Chicken, hill fowl, Texture.

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$CHETANA\ PANT, PRANEETA\ SINGH^*, NIDDHI\ ARORA\ AND\ K.\ P.\ SINGH.$

DEPARTMENT OF LIVESTOCK PRODUCTS TECHNOLOGY, COLLEGE OF VETERINARY AND ANIMAL SCIENCES, GBPUAT, PANTNAGAR-263145, UTTARAKHAND, INDIA

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The meat obtained from Uttarafowl (PB), Rhode Island Red (RIR) and their cross (UFxRIR) (CB) was converted into an enrobed and dry cooked product Breaded chicken chops. The product prepared from three groups was compared for different quality characteristics and texture profile analysis. The study revealed that marinade uptake, shrinkage% and cooking losses showed significantly (P<0.05) higher values for PB compared to RIR and CB and CB exhibited the values significantly (P<0.05) higher than RIR. Proximate composition of breaded chicken chops prepared from the meat of three breeds showed that a significant (P<0.05) difference existed among the moisture values of breaded chicken chops of RIR, CB and PB. Fat values for breaded chicken chops of PB showed the highest value followed by RIR and CB. Non-significant differences existed between the protein values of CB and PB. PB showed significantly (P<0.05) higher values of ash compared to the other two breeds. Texture profile analysis of breaded chicken chops prepared from the meat of RIR, CB and PB showed significant (P<0.05) differences between the three breeds with respect to hardness, chewiness and adhesiveness with PB possessing the maximum hardness and adhesiveness while CB showed the maximum chewiness values. Sensory scores for all the attributes viz. colour and appearance, texture, flavor, juiciness and overall acceptability were significantly (P<0.05) higher for PB followed by CB and RIR. Based on above findings it can be concluded that Uttarafowl and their crosses possess all the potential to provide quality meat and serve as an alternative to broiler meat under minimal raising conditions.

Key words: Uttara fowl, Chicken, hill fowl, Texture.

FABRIC DEVELOPMENT USING HIMALAYAN NETTLE FIBER *MANISHA GAHLOT, POOJA BHATT AND DEEPTI PARGAI COLLEGE OF HOME SCIENCE, GBPUAT, PANTNAGAR-263145, UTTARAKHAND, INDIA

Unconventional fibres are gaining attention in the present era due to its sustainable nature. Different kinds of unconventional fibres are available in Uttarakhand but very few have a possibility for creating livelihood for local community. Himalayan nettle is a one of them. It is a perennial plant found growing in temperate and sub-tropical Himalayas, between 1200 to 2900 meters above sea level. It is found to be occurring abundantly in the Garhwal region of Uttarakhand. In the present study different types of fabric structures were developed by using Himalayan nettle fiber according to different end uses. Pure nettle fabric was prepared using hand spun nettle yarn. Two union fabrics, in which machine spun nettle yarn (Count=7.22 Ne) in weft direction and merino wool yarn (Count = 240 worsted count) was used in warp direction. One union fabric was prepared using diamond weave (Fabric 1) and another was made with herring bone weave (Fabric 2). Non woven fabric was prepared from the nettle fibres using needle punching technique. All the prepared fabrics were tested for physical and mechanical properties. Results of study revealed that non-woven fabric had highest value for the GSM and had highest elongation in both warp and weft directions and moderate air permeability as compared to the woven fabric. It can be an eco friendly alternative for acoustic and agro textiles. 2-ply varn was used for developing woven fabric, which can be suitable choice for mulching material in agriculture. Union fabric 1 had good breaking and tearing strength. The fabric showed good bending and crease recovery angle which provided sturdiness and better drape. Better physical properties enhanced its suitability as outer garment in winter season such as coat, jacket or vest. Union Woven nettle fabric 2 has very good air permeability and low GSM. This made fabric a good choice as stole or shawls. Exploration of nettle fibre through different fabric structure development can also help the rural hill population in providing sustainable source of income through commercialization of products.

Key word: Himalayan Nettle, Bast Fiber, Unconventional Fibres, Woven, Non Woven, Uttarakhand

EFFECT OF REACTIVE DYEING ON PROPERTIES ON MULBERRY SILK WASTE/WOOL BLENDED FABRIC POOJA BHATT* AND SANDEEP BAINS** DEPARTMENT OF CLOTHING AND TEXTILES, GBPUAT, PANTNAGAR

DEPARTMENT OF CLOTHING AND TEXTILES PAU, LUDHIANA

Both silk and wool are a protein fiber due to the presence of many amines, carboxylic acid, amide, and other polar groups, so these possess similar chemical properties. Silk is chemically related to wool because the amino groups which are integral components of both the fibers, thus both can be dyed with the same dyes. In the present study an attempt was made to give a clear picture about the dyeing of mulberry silk waste/wool blended fabric with reactive dye and its impact on fabric properties were studied. From the results of the present study it can be stated that the mulberry silk waste/wool blended fabric can be dyed easily and effectively with reactive dyes. The results of study revealed that the mulberry silk waste/wool blended fabric can be dyed at slightly acidic or neutral medium for 60-80 minutes at 90°C. The study concluded that the physical and mechanical properties like crease recovery angle and tensile strength increased after dyeing the fabric with reactive dye. Fabric dyed using reactive dyes exhibited better fastness properties. The value addition of mulberry silk waste/wool blended fabric through dyeing, can lead to its diversified uses in the apparel and home textiles. This study will be helpful for the traditional dyers in improving the dye uptake and colour fastness quality of traditional textiles which will enhance their domestic and export marketability and consequently preserve the textile heritage of India. It will also help dyers in diversifying their product range. **Key words:** Silk, Wool, Reactive Dye, Value Addition, Blended Fabric

RESEARCH STUDIES ON COST AND IMPACT OF IMAGE MAKE-OVER IN APPAREL FASHION STUDIOS

CHALLA LAKSHMI¹ AND ALKA GOEL²

DEPARTMENT OF CLOTHING AND TEXTILES, COLLEGE OF HOME SCIENCE,

G.B.PANT UNIVERSITY OF AGRICULTURE AND TECHNOLOGY, U.S.NAGAR DISTRICT, UTTARAKHAND

Make over refers to complete transformation of the appearance of someone or something. It is a no secret that a common problem among women today is "what to wear" and "what to pair". This can be a continual discouragement for many and lead to a decrease in self-esteem. The answer is fashion makeover. A makeover gives a person the ability to feel empowered and encourage them to envisage their positive attributes. The Fashion make-over deals with planning of an individual, group, community, etc. Hence, the present study was taken up to assess the cost of makeover of any individual, organization or office. The area of study selected were Bangalore and Hyderabad as both the cities are highly fashion conscious and were regarded as garment city and high-tech cities of South India . The population for study of customer point of view for make over business included highly fashion conscious people, celebrities and working class people and socially active people. The study comprised of sample size 25 for fashion studios and Sample size for Customers as Bangalore:50 and Hyderabad:50. The objectives for the above study were to analyze the skills required for running a fashion make over business, to study the infrastructural requirements and economical aspects of the makeover business, etc. The study resulted in getting a better idea towards organising and functioning of fashion make over businesses on a whole. It was also proved that there is a direct relation between profession, personal taste and make-over cost. The skills, presentation tactics had a great impact on makeover suggestions. These help in not only giving a good make up, beauty treatment, but also will provide their client with personalised wardrobe solutions and styling tips and tricks based on their body type, cultural significance, profession, and all other related parameters.

Keywords: Lifestyle, Wardrobe, Promotion, Strategy, Community, Budgeting, Expenditure, Planning, Creativity, Public relations.

QUALITY IMPROVEMENT IN CHICKPEA

¹RAVI PRAKASH CHAUDHARY, ²HARENDRA PRATAP SINGH CHOUDHRI

¹DEPARTMENT OF GENETICS AND PLANT BREEDING, ANDUAT KUMARGANJ AYODHYA- 224229 (U.P.) ²DEPARTMENT OF AGRICULTURAL ECONOMICS, ANDUAT KUMARGANJ AYODHYA- 224229 (U.P.)

Chickpea is an important grain legume of the semi arid tropics and worm temperate zone, and forms one of the major components of human diet. However, a narrow genetic base of cultivated chickpea(Cicer arietinumL.) has hindered the progress in realizing high yield grain in breeding programs. Relationships among the species of genus Cicer are presented based on cross ability, karyotype and molecular markers. The reproductive barries encountered during interspecific hybridization are also examined. Molecular markers such as SSR and SNP are useful for construction of high density genetic maps of chickpea. These maps will be useful in identification of gene/QTLs associated with quality traits for undertaking expensive molecular breeding in chick pea. Recent information on genetic linkage maps, comparison of isozymes and different DNA marker systems used for diversity analysis in chickpea germplasm, tagging of genes/QTLs for qualitative and quantitative traits and progress in application of marker assessed selection and genomics in chickpea are presented. **Key word**; Genetic linkage maps, Germplasm, QTLs, Marker assisted selection.

LOCAL SOIL TAXONOMY – AN INDIGENOUS KNOWLEDGE BASE OF LOCAL FARMERS IN EASTERN-GHAT HIGHLAND ZONE OF ODISHA

BIBUDHA PARASAR

DEPTT. OF AGRICULTURAL EXTENSION, INSTITUTE OF AGRICULTURAL SCIENCES, S'O'A, (DEEMED TO BE UNIVERSITY), BHUBANESWAR, ODISHA

Knowledge that is unique to a given culture and society is the information base of the society. Codified in the language of the society, facilitates communication and decision making. At present, indigenous knowledge passes from generation to generation orally. Like many other knowledge systems of ancient Indians, it is likely to be lost in the wake of intensive intervention and as people become old and leave this world. Thus it is in the above context and background a search was made to identify and document the existing indigenous knowledge of farmers of eastern-ghat high land zone out of ten agroclimatic zones of Odisha with an anthropological approach for the said study by following participant observation technique. Findings: The scholar was tempted to develop an understanding about the existing soil taxonomy of the locality which was done by the local farmers of the study area on the basis of their age old observations and experiences. The soils of the locality have been broadly classified into two main categories on the basis of its use. They are "chas mati" used for farming or cultivation purpose and "ghar mati" used for domestic use or non-agricultural activities. Chas mati again classified as Balia Mati, Chikat Mati, Morum Mati, whereas Ghar Mati is further classified as Rangmati (Red Soil), Haldi Mati (Yellow Soil), Dhoba Mati (White Soil) and Kala mati (Black Soil). The identification of various type of type of chas mati is done on the basis of criteria followed by the local people and the crop suitable for a particular soil type along with the type of ghar mati and its use such as coloring or painting the wall, floor, washing the heads and clothes etc.

Keywords: Indigenous Knowledge, Anthropological Approach, Ghar mati, Chas mati

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EFFECT OF FOLIAR APPLICATION OF NUTRIENTS, PLANT GROWTH REGULATORS AND POLLINATOR ATTRACTANT ON GROWTH AND FLOWERS ON CASHEW (*ANACARDIUM OCCIDENTALE* L.) CV. VENGURLA-4 J. A. WAGHMODE, R. C. GAJBHIYE, R. G. KHANDEKAR, M. M. KULKARNI, R. T. BHINGARDE, S. R. BHAGWAT, A. V. BHUWAD, O. A. NIRMAL, S. P. KADAKE AND B.R. SALVI DEPARTMENT OF HORTICULTURE, COLLEGE OF HORTICULTURE, DAPOLI, DISTRICT – RATNAGIRI DR. B. S.

DEPARTMENT OF HORTICULTURE, COLLEGE OF HORTICULTURE, DAPOLI, DISTRICT – RATNAGIRI DR. B. S. KONKAN KRISHI VIDYAPEETH, DAPOLI

The present investigation was conducted at the Department of Horticulture, College of Agriculture, Dapoli, Dist. Ratnagiri during the year 2017-2018. The experiment was laid out in Randomized Block Design with three replications and seven treatments including control i.e. T_1 - Amrashakti Multi nutrients @ 2.5%, T^2 - Combination of derivatives of thioproline, folic acid, brassinolides @ 1.5% first spray and 2% second spray, T_3 - Combination of derivatives of thioproline, folic acid, brassinolides @ 1.5% second spray and 2% third spray, T_4 - Urea @ 2%, T_5 - 19:19:19 @ 2%, T_6 - Dried fish extract @ 5%, T_7 - Control. All the treatments were applied as foliar spray at different phenological stages of cashew *i.e.* treatment T_1 , T_4 and T_5 were applied at flushing, flowering and fruit set while, T_2 and T_3 were applied at fruit set and 15th and 30th days after first spray. Whereas, treatment T_6 was applied at flowering stage and 15 days after first spray. Recommended dose of manures and fertilizers *i.e.* 4 baskets FYM, 1000g N, 250g P₂O₅ and 250g K₂O per tree per year were applied in the month of August to all the experimental trees including control as common application. The observations on growth and flowering. Results revealed that production of laterals per m² (29.33) and panicle per m² (20.67) were recorded significantly the maximum when plant sprayed with 19:19:19 2% (T_5) and followed by urea 2% (T_4) (94.67 days). This was about 8 days shortened than control and resulted in early harvest of the crop by 8 days. The results of present study inferred that, the foliar application of 19:19:19 @ 2% at flushing, flowering and at fruit set are favorable to influence the growth characters flowering early harvest in cashew cv. Vengurla-4. **Keywords**: Cashew, nutrient, plant growth regulator, pollinator attractant

INTEGRATED MANAGEMENT OF WHITEFLY IN COTTON CROP SONU KUMARI¹, SUDHANSHU BALA NAYAK² AND MONIKA YADAV²

DEPARTMENT OF ENTOMOLOGY, CHAUDHARY CHARAN SINGH HARYANA AGRICULTURAL UNIVERSITY, HISAR In India, Cotton known as "White Gold", is the premier commercial crop. Among the different constraints that limit the yield of cotton in India, white fly are considered to be the most serious. There are many approaches for controlling this pest viz., physical, cultural, biotechnological, biological, chemical, biopesticides and biorationals. Yellow sticky traps in various forms can catch large number of whiteflies (Gerling and Horowitz, 1984). There are cultural practices such as avoidance in time, avoidance in space and behavioural manipulations to manage whiteflies (Hilje *et al.*, 2001). Biopesticides such as fungi and azadirachtin are also used to manage whitefly. In pot culture, 2% concentration of mineral oil + neem oil and mineral oil + *Pongamia glabra* seed oil were effective against *Bemisia tabaci* with a mean population reduction of 81.83% and 81.52% respectively. Predators : *Brumoides suturalis Serangium parcesetosum Cheilomenes sexmaculata, Chrysoperla zastrowi, Coccinella septempunctata* and a parasitoid, *Encarsia lutea* were identified in Haryana (Kedar *et al.*, 2014). Pyriproxyfen 10 EC @ 125gm a.i/ha was found most effective Insect Growth Regulator against whitefly (Kumar *et al.*, 2014). Imidacloprid proved to be the most effective insecticide against whitefly upto seven days after application (Afzal *et al.*, 2014). Spiromesifen 240 SC @ 0.4 ml/lt followed by buprofezin 10 EC @ 1.0 ml/lt were found as the most effective treatments with more than 75 per cent mean reduction in nymphal population of whiteflies (Maha Lakshmi *et al.*, 2015). A chitin inhibitor gene Tma12 from a fern *Tectaria spp.* was identified for whitefly defence. RNA interference (RNAi)- mediated gene silencing was explored for the control of *Bemisia tabaci* (Upadhyay *et al.*, 2011).

Key words: Whitefly, cultural control, biocontrol agents and chemical control

TAXONOMY OF A NEW *APROSTOCETUS* (HYMENOPTERA: EULOPHIDAE) ASSOCIATED WITH THE LEAF GALL OF TERMINALIA *ARJUNA* FROM UTTARAKHAND, INDIA

VISHAL KUMAR¹, SANGEETA RAWAT², PUJA PANT³, SUNAULLAH BHAT⁴, SANDEEP KUMAR⁵

INSECT BIOSYSTEMATICS & INSECT-PEST MANAGEMENT LABORATORY, DEPTT. OF ZOOLOGY, KU SSJ CAMPUS, ALMORA

The main objective of this study to explore the diversity of Eulophids particularly Tetrastichine wasps and their host-parasite relationships on *Terminalia arjuna* as well as the importance of these parasitoid in natural bio control. The whole investigation accomplished during the months of August to September in the year of 2019. This species of genus *Aprostocetus Westwood* (Hymenoptera: Eulophidae) has been described from Khatima, Udham Singh Nagar, India. During the taxonomic investigation authors found one species from pit galls on *T. arjuna* plant which is new to Biological Science. This new species was distinguished from other allied species *Aprostocetus rajai* Narendran by various morphological characters. *T. arjuna* is a very economically important plant and it have use in many medicinal purpose. Various parts of *T. arjuna* has been used for curing of many diseases *viz.*, asthma, bile duct disorders, scorpion stings, and poisonings. The bark of *T.arjuna* primarily used in the remedy of heart related diseases. For the healthy production of leaves of *T.arjuna*, this parasitic wasp can be used to manage the infestation caused by this pest.

Keyword: Eulophids, Tetrastichine, Aprostocetus Westwood, Terminalia arjuna

STUDY OF PARASITIC HYMENOPTERAN EULOPHIDS EXPLORED FROM, *PAPAVER SOMNIFERUM* LEAF MINER, (DIPTERA: AGROMYZIDAE) FROM ALMORA, UTTARAKHAND PUJA PANT, VISHAL KUMAR, SANGEETA RAWAT, SANDEEP KUMAR

DEPTT.OF ZOOLOGY, KU SSJ CAMPUS, ALMORA, UTTARAKHAND, INDIA

The family Agromyzidae is a large group of the order Diptera, including more than 3,000 species assembled in about 30 genera. Agromyzids have been considered as one of the most important groups of insect pests, especially on vegetables and ornamental plants. The infested leaves of poppy, *Papaver somniferum* with leafminer, *Liriomyza* (Diptera:Agromyzidae) were collected during the month of may 2019. In this study two species of eulophid parasitoids were emerged which are belongs to the subfamily Eulophinae (Hymenoptera:Chalcidoidea). The subfamily Eulophinae are commonly used in biological control programs against dipteran and

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lepidopteran leaf-mining pests. The larvae construct mines in leaves, consume leaf tissues and damage is mainly caused by the maggots which feed by mining into the leaves and affect the photosynthesis of the plant drastically. Study of these parasitoids will be helpful in understanding their specific role in control of *Liriomyza*, population. Certainly regular efforts in management of these parasitic wasps will contribute in the reduction of indiscriminate use pesticides. Thus, the objective of this study was to identified the Agromyzid leafminer, and its hymenopteran parasitoids.

Key words: Agromyzidae, Papaver somniferum, Eulophinae, Hymenoptera

THE ROLE OF MEDICAL GEOLOGY IN ENVIRONMENTAL AND HUMAN HEALTH SUMANA ROY¹

¹DEPARTMENT OF EARTH SCIENCES, INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

The emerging science of "medical geology as a transdisciplinary research discipline" assesses the complex relationships between geoenvironmental factors and their impacts on humans and environments. Integrated medical geology promises a more comprehensive understanding of the occurrence, mobility, bioavailability, bioaccessibility, exposure and transfer mechanisms of geogenic contaminants (GCs, example F, Rn, Se) to the food-chain and humans and the related ecotoxicological impacts and health effects. Exposure to GCs such as metals (Mn, Be, Cd, Hg, Pb) or metalloids (As), radioactive metals and isotopes as well as transuraniums (U, Pu) occurring naturally in geogenic sources (rocks, minerals) can negatively impact on environmental and human health. The GCs are released into the environment by natural biogeochemical processes within the surface environments by anthropogenic activities such as mining and hydrocarbon exploration as well as exploration of geothermal resources. They can contaminate soil, water, air and biota and subsequently enter the food chain with often serious health impacts. Global population explosion and economic growth and the associated increase in demand for water, energy, food, and mineral resources demonstrate the close linkage of medical geology to most of the 17 Sustainable Development Goals in the 2030 Agenda for Sustainable Development. Scientific evidence based on this approach will support adaptive solutions for prevention, preparedness and response regarding human and environmental health impacts originating from exposure to GCs. **Key words:** medical geology, geogenic contaminants, food chain, human health, toxic trace elements, water resources

ASSOCIATION OF INTENSE GEOMAGNETIC STORMS WITH SOLAR WIND SPEED FOR SOLAR CYCLE 24

CHANDNI MATHPAL, LALAN PRASAD

DEPARTMENT OF PHYSICS, GOVT. P.G. COLLEGE, BERINAG-262531 PITHORAGARH UTTARAKHAND, INDIA

We have studied the association of intense geomagnetic storms ($-200 < Dst \le -100nT$) for the solar cycle 24 with solar wind speed. For our study, we used the Kp index as a sign of geomagnetic storm. In order to find the association of geomagnetic storm (GS) with solar wind speed, we incorporate the analysis technique by superposed-epoch method. The current analysis depict that solar wind speed V is a geo-effective parameter. In addition to this, we also found that Kp index is also a geo effective parameter. Furthermore, the time delay analysis has also been performed by the method of correlation for the introduced parameter.

Keywords Solar Wind Speed, Geomagnetic Storms, Kp Index.

CHARACTERIZATION AND PLANT GROWTH PROMOTING ATTRIBUTES OF PLANT GROWTH PROMOTING BACTERIA (PGPB) ON WHEAT UNDER DROUGHT CONDITION

SUDHA BIND* AND A.K. SHARMA

DEPARTMENT OF BIOLOGICAL SCIENCES, COLLEGE OF BASIC SCIENCE AND HUMANITIES, G. B. PANT UNIVERSITY OF AGRICULTURE AND TECHNOLOGY, PANTNAGAR

Drought is the major limiting factor on agriculture productivity across the world also tend to increase due to climate change. Several strategies are required to cope with drought stress. PGPB alleviate the drought stress thus enhance the plant growth by several mechanism which includes (1) N2 fixation (2) solubilization of immobilized mineral nutrients (phosphorus , zinc) and mineralization of organic phosphorus compounds (3) sequestration of iron by siderophores (4) production of phytohormones (auxins, cytokinins and gibberellins) (5) amino-cyclopropane-1-carboxylic acid (ACC) deaminase activity (6) volatile compound production (8) antibiotic production (7) induced systemic resistance (ISR) (8) production of hydrogen cyanide (HCN). 16 bacteria were isolated from root, leaf and seed of rice variety Sahbhagi. Glass house experiment was conducted with all isolates on wheat variety PBW343 under drought and irrigated conditions. All isolates showed enhancement of root, shoot length and biomass. Treatments showed greater Enzyme activity (SOD, POD, CAT), protein, chlorophyll and macronutrient (N, P, k, Na, Ca) content than the control. Out of 16 bacterial isolates, 2 bacteria showed promising effect on plant growth. Isolates, Seed 8 and Seed 16 increased the Shoot length (25.5%, 23.5%), Root length (22%,19.66%), Shoot fresh weight (47%, 35%) Root fresh weight (51.8%, 43.4%), Shoot dry weight (59%, 38.1%), Root dry weight (62.4 %, 34.7%) respectively than the control under drought condition and Shoot length (25.4 %, 23.3%), Root length (15.3%, 13.2%), Shoot fresh weight (60.1%, 58.5 %), Root fresh weight (59.9%, 59.7%), Shoot dry weight (51.4%, 41.6%) and Root dry weight (46.9%, 46.3%) respectively than the control under irrigated condition.

Key words- PGPB, Drought, ACC deaminase

THE IMPACT OF GLOBALISATION ON FOOD AND AGRICULTURE IN THE CASE OF THE DIET CONVERGENCE RAJESH KUMAR DEWANGAN, DR. RAMCHANDRA AND HARISCHANDRA DARRO DEPARTMENT OF AGROFORESTRY, SCHOOL OF FORESTRY & ENVIRONMENT, SAM HIGGINBOTTOM INSTITUTE

OF AGRICULTURE, TECHNOLOGY AND SCIENCES, (DEEMED TO BE UNIVERSITY), ALLAHABAD (U.P).

Globalisation drives a process of diet convergence among developing and developed countries that challenges the predictions about future patterns of food consumption. To address this issue, the objective of this paper is to map the range of the possible future diet changes, and to explore their impact on agriculture using the NLU land-use model. This model computes agricultural intensification in the crop and livestock sectors at the global scale, based on an architecture accounting for the different types of food calories. By considering four scenarios built upon distinct assumptions regarding diet convergence, this paper sheds light on the pivotal role of diet changes as drivers of tensions on agriculture and land-use, and shows the uncertainty associated with processes of diet convergence for foresight exercises on
food and agriculture. Finally, the interactions between food production and the other land-use patterns are explored by testing the sensitivity of our results to assumptions regarding bio fuel production, deforestation, potential crop yields and nutrient use efficiency. **Keywords**: globalisation, shift in diets, land-use change.

APPLICATIONS OF REMOTE SENSING AND GIS IN NATURAL RESOURCE MANAGEMENT DIVYA KHATRI¹, ABHISHEK ASWAL², ACADEMY SUTNGA³

INSTITUTE OF AGRICULTURAL SCIENCES, BANARAS HINDU UNIVERSITY, VARANASI, U.P.

Remote sensing and Geographical Information System (GIS) offers an abundant opportunity to monitor and manage natural resources at multi-temporal, multi-spectral and multi-spatial resolution.GIS technology provides a flexible environment for storing, analyzing, and displaying digital data necessary for change detection and database development. Satellite images has been used to provide both spatial and temporal information needed to monitor in agriculture including biomass and yield estimation, vegetation vigor, slope and erosion status and drought stress monitoring, assessment of crop phenological development, crop acreage estimation and cropland mapping, land resource mapping, land use and land cover changes in addition to precision in agriculture and irrigation management, monitor changes in water quality parameters ,measure chlorophyll concentrations on empirical relationships with radiance or reflectance, generate information regarding forest cover; types of forest present within an area of interest, human encroachment extent into forest land / protected areas, encroachment of desert like conditions which is crucial information for the development of forest management plans and in the process of decision making to ensure that effective policies should put in place to control and govern the manner in which resources can be utilized. The suitability and status of sites / forest area for a particular species of wildlife can also be assessed using remote sensing data. Extensive multi-temporal spatial data is required for the management of natural disasters such flooding, earthquakes, volcanic eruptions and landslides. Remote sensing data can greatly contribute to the monitoring by providing timely, synoptic, cost-efficient and repetitive information about the earth's surface.

Keywords: Crop Acreage, Encroachment, Remote Sensing, Soil Mapping.

FOOD SECURITY OF PULSES WITH ENVIRONMENTAL SAFETY BY USING NEW GENERATION INSECTICIDES. E. SIREESHA^{*1}, GAJE SINGH² AND RAJENDRA SINGH³

DEPARTMENT OF ENTOMOLOGY, SARDAR VALLABHBHAI PATEL UNIVERSITY OF AGRICULTURE AND TECHNOLOGY, MEERUT-250110 (U.P).

Pulses occupy a unique position in the agricultural economy of India being a major source of proteins in Indian dietary. Among the pulse pests, Spotted pod borer, *Maruca vitrata* (Geyer) is a serious pest of legumes grains because of its extensive host range, destructiveness and distribution on pigeonpea, cowpea, mungbean, urdbean and field bean in many parts of India Maruca larvae feed on buds, flowers and pods by webbing them. This type of typical concealed feeding protects the larvae from natural enemies, human interventions and other adverse factors. To ensure food security this pest must be controlled, maintaining environmental safety *i.e* possible by using eco-friendly new generation insecticides. Many research studies revealed that spinosad 45% SC, emamectic benzoate 5% SG followed by chlorantraniliprole 20% SC, indoxacarb 14.5% SC, and novaluron 10% EC were found to be effective when compared to control, proving their efficacy against the resistant population of spotted pod borer. Also the other recommendations like indoxacarb14.5% SC + acetamiprid and Profenophos 50% EC were proven to be most effective treatments showing 65 - 75% reduction in larval population with maximum yield of 8-9 q/ha, over control in many pulses especially in green gram. The highest cost benefit ratio was also found to be obtained by many researchers working with these above insecticides.

Keywords: Spinosad, Emamectin benzoate, Chlorantroniliprole, food security, environmental safety.

NUTRITIONAL STATUS OF TWO SNOW TROUT SPECIES FROM A PARENT TRIBUTARY OF RIVER GANGA: A CONTRIBUTION TOWARDS NUTRITION SECURITY AND CONSERVATION GOAL SHARALI SHARMA*, DEEPAK SINGH

FRESHWATER BIODIVERSITY LABORATORY, DEPARTMENT OF ZOOLOGY AND BIOTECHNOLOGY, H.N.B. GARHWAL UNIVERSITY, SRINAGAR GARHWAL, 246 174, UTTARAKHAND, INDIA

The present study is aimed at to determine the biochemical composition and level of mineral elements in the muscle tissue of two snow trout species namely, *Schizothorax plagiostomus* and *Schizothoraichthys progastus*. Fish samples were collected from Alaknanda, a tributary of river Ganga, with the help of local fishermen. Protein, lipid, carbohydrate, moisture and mineral elements were investigated following Lowry *et al.* (1951), Folch *et al.* (1957), Dubois *et al.* (1956) and AOAC (2000), respectively. The results revealed that both *S. plagiostomus* and *S. progastus* were almost equally rich in protein (18.32 and 18.48%) and lipid contents (2.05 and 2.06%) and falls under low-fat fish category. Among the macroelements, maximum amount of Na (96.31 mg/100gm) was present in *S. progastus* while maximum amount of K (303.40 mg/100gm) and Ca (386.28 mg/100gm) in *S. plagiostomus*. Among the trace elements, *S. progastus* was observed to possess high level of Fe (18.24 mg/100gm), Zn (3.05mg/100gm), Cu (0.72mg/100gm) and Pb (0.28mg/100gm) contents. The abundance trend for mineral elements in the muscle tissue was observed as Ca>K>Na>Fe>Zn>Cu>Pb. The level of Zn, Cu and Pb in the muscle tissue of both the fish species were found well below the highest permissible limits as set by FAO (1983) thus free from any toxicity hence, may be recommended in daily meal. The culture, augmentation and conservation of these fishes will ultimately contribute towards food and nutrition security.

Keywords: Alaknanda, macroelements, S. plagiostomus, S. progastus, trace elements.

TO STUDY THE USEFULNESS AND UTILITY OF KISAN MOBILE ADVISORY SERVICE (KMAS) BY THE FARMERS DILIP S.¹, JOGINDER SINGH MALIK ². NAVINKUMAR³, AND SHIKHA BIDHAN⁴

1,2DEPT. OF EXTENSION EDUCATION, CCS HARYANA AGRICULTURAL UNIVERSITY, HISAR

3DEPT. OF AGRIL. EXTENSION EDUCATION, UAS, RAICHUR.

4DEPT. OF SOCIOLOGY, CCS HARYANA AGRICULTURAL UNIVERSITY, HISAR

Agriculture in India comprising of crops, dairy, fishery, horticulture, agroforestry along with small enterprises like beekeeping, mushroom growing etc needs the use of modern technologies to achieve the target growth. Need of the how is to harness productivity along with

sustainability, minimize post harvest losses and getting appropriate prices for the produce. For this, extension has to play expanded role including improved access to markets, research, advice, credit, infrastructure, development of farmer organization and business development services. Kisan Mobile Advisory Service scheme is main line extension system of Krishi Vigyan Kendras, is new ICT initiatives to meet the needs and expectations of the farmers with the aim of passing the agricultural information to maximum number of farmers in local language through SMS free of cost. Telephone had established itself in the rural areas and was becoming quite popular both with farmers and farm women. This powerful electronic media that was a farmers' dream earlier has become a reality, as farmers can immediately make use of it to address their field problems and other farm difficulties. Mobile phones and development: An analysis of IDARC-Supported Projects reported that mobile phones require only basic literacy, and therefore are accessible to a large portion of the population. Finally, mobiles enjoy some technical advantages that make them particularly attractive for development. In addition to voice communication, mobile phones allow for the transfer of data, which can be used in the context of application for the purposes of health, education, commerce or governance.

Key words: Extension system, Kisan Mobile Advisory Service

UTILITY PATTERN OF ICT TOOLS FOR TRANSFER OF TECHNOLOGY (TOT) BY THE EXTENSION PERSONNEL DILIP S.¹, JOGINDER SINGH MALIK². NAVINKUMAR³, AND SHIKHA BIDHAN⁴

1,2DEPT. OF EXTENSION EDUCATION, CCS HARYANA AGRICULTURAL UNIVERSITY, HISAR

3DEPT. OF AGRIL. EXTENSION EDUCATION, UAS, RAICHUR.

4DEPT. OF SOCIOLOGY, CCS HARYANA AGRICULTURAL UNIVERSITY, HISAR Information and Communication Technology (ICT) in Agriculture is emerging field focusing on the enhancement of agricultural and other

development in India. The Agriculture sector is gearing itself to make optimal use of the new information and communication technologies. The diffusion of ICTs has contributed enormously to the growth of economies in developed nations and developing nations and is earnestly facilitating policy framework to ensure an equitable diffusion of new technologies. Agriculture is an educational service which brings information and new technologies to farming communities to enable them to improve their production, income and standard of living. At present the extension personnel in department of agriculture has the major responsibility of transferring technologies to the farming community from time to time. But at this juncture the extension agents face number of problems in contacting farmers and the researchers due to physical distances and lack of transportation etc. Hence, the application of ICT offers excellent possibilities, for strengthening TOT between research and extension system and further onward transmission to the end-users. Thus, for effective and efficient service delivery, the extension service and research organization need to be appropriately supported with the use of ICT tools. To determine the level of utilization of Information Communication Technology (ICT) for agricultural extension activities by Agricultural Extension officers to findings revealed that public extension officers utilized a wider range of ICT (especially the broadcast and print ICT) than their private agency counterparts. Private extension officer, however, utilized more of telecommunication / computer ICTS, which are faster, means of accessing agro – technological information.

Key words: Information Communication Technology (ICT), Agriculture.

CONSTRAINTS AND SUGGESTIONS PERCEIVED BY TEACHERS IN SCHOOL VEGETABLE GARDENING DILIP S.¹, ALLAN THOMAS ², JOGINDER SINGH MALIK³ AND NAVINKUMAR ⁴ DEPT. OF EXTENSION EDUCATION, CCS HARYANA AGRICULTURAL UNIVERSITY, HISAR DEPT. OF EXTENSION EDUCATION, KERALA AGRICULTURAL UNIVERSITY, TRISSUR. DEPT OF EXTENSION EDUCATION, CCS HARYANA AGRICULTURAL UNIVERSITY, HISAR DEPT. OF AGRIL. EXTENSION EDUCATION, UAS, RAICHUR.

Agricultural activities have produced a variety of educational benefits in primary school students. It has deepened the recognition of the importance of feeling nature, enhanced the ability of self-control and widened the understanding toward work. Vegetables are an important source of food and nutrition. The vegetable garden considered as livelihood laboratory, engages teachers by providing an energetic environment for them to observe, discover, experiment, nurture, and learn. Lessons are internalized from real-life experiences rather than textbook The study was conducted in Thiruvananthapuram district of Kerala to identify the constraints experienced by teachers in the course of engaging in school vegetable gardening programme. Ten schools were selected for data enumeration. A total of 130 respondents with 100 students comprising ten students each and 30 teachers comprising three each, from each school were selected for meeting the objectives of the study. The reaction to each constraint was obtained on a four-point continuum namely most important, important, less important and least important with the score 4, 3, 2 and 1 respectively. Mean rank cumulative index for each constraint was worked out and the constraints were ranked and catalogued. The major constraints as perceived by teachers in school vegetable garden projects were, high input cost followed by lack of student's participation, lack of protection implements, non-availability of implements, high labour cost, lack of student's interest and lack of knowledge about gardening.

Key words: Vegetables garden, Constraints.

CONSTRAINTS FACED BY AGROMET ADVISORY SERVICE FARMERS DILIP S.¹ AND JOGINDER SINGH MALIK²

DEPT OF EXTENSION EDUCATION, CCS HARYANA AGRICULTURAL UNIVERSITY, HISAR

Agromet Advisory Service (AAS) deals with extension agrometeorology and is defined as all agrometeorological and agro-climatological information that can be directly applied to improve and/or protect the livelihood of farmers. AAS has been adopted at district level since 2008 by the India Meteorological Department (IMD) and is continued even now. The district level AAS is provided to farmers making use of medium range weather forecast of the National Center for Medium Range Weather Forecasting (NCMRWF) and IMD. However, the validity of blanket advisories disseminated at district level has limitations, particularly in view of the large variability in terms of crops, varieties and spatial weather anomalies at this level. Keeping in view the recent variability in weather and climate, the Central Research Institute for Dryland Agriculture (CRIDA), Hyderabad pioneered in starting a flagship research programme of the Indian Council of Agricultural Research (ICAR) named 'National Innovations in Climate Resilient Agriculture (NICRA)'. The project aims to enhance resilience of Indian agriculture to climate change and climate vulnerability through strategic research and technology demonstration. The

major constraints faced by farmers were, lack of technical skills and capacities for adoption of technologies, lack of awareness and sensitization to the development and utilization of new technologies, non-availability of timely inputs, lack of information about long term climate change, higher cost in adoption of new technology, lack of extension services in technology dissemination and lack of investment capital and land tenure issues. The probable reasons for this might be, recent years farming is taking place in small scale with low per capita land availability, low income group, lack of cosmopoliteness. It is highly difficult for them to adapt suitable technologies in their field. By this we can know that farmers are facing constraints in adopting mitigation strategies. The farmers to adopt recommended mitigation strategies to mitigate ill effects of climate change. These constraints have to be suitably resolved by the respective departments to make the agriculture as profitable proposition.

Key words: Agriculture, Climate change.

VARIATION OF NOISE LEVELS DURING DEEPAWALI FESTIVAL AT MUTTHIGANJ, PRAYAGRAJ (ALLAHABAD), UTTAR PRADESH

MOHD NAFEES*, SATYENDRA NATH*, AVDHESH KUMAR**

*DEPARTMENT OF ENVIRONMENTAL SCIENCES & NRM, COLLEGE OF FORESTRY, SHUATS -211007 **DEPARTMENT OF AGRICULTURAL EXTENSION & COMMUNICATION, SHUATS -211007

Noise is an unwanted, obnoxious and petulant sound that may cause psychological and physiological related problems. Continuous noise pollution monitoring and assessment is an important task for minimizing the noise pollution and its adverse effect on human being. According to World Health Organization noise pollution is a third most hazardous pollution after air and water pollution. It causes significant health effects, such as heart problems, change in social behaviour and quality of life. Deepawali is celebrated with the bursting of loud noise firecrackers, lighting and playing loud speakers which ultimately increase the noise levels. Present monitoring study was perform in the year of 2017 at Mutthiganj (Residential cum commercial area) during Deepawali festival. Monitoring and observed value of noise levels indicated that noise level during the deepawali were increases. The maximum L₁₀, L₉₀ and L_{eq} observed 120.9 dB at 8:50 PM, 77.9 dB at 9:30 PM and 136.4 dB at 8:50 PM and the minimum 86.5 dB at 8:35 PM, 68.3 dB at 8:25 PM and 82.9 dB at 8:35 PM respectively. The result of the study revealed that the observed values were higher than the standard limits of noise prescribed CPCB, New Delhi. Firecrackers and loud speakers were the main reason of higher noise levels during Deepawali. **Key word**: *Noise pollution, deepawali, Mutthiganj, Health effect.*

Key word. Noise politilon, deepawaii, muuniganj, meann ejjeci.

DYEING OF SILK FABRIC USING FUNGAL DYE AND NATURAL MORDANT <u>HIMANI VERMA¹</u>, ANITA RANI², ANIL KUMAR SHARMA³ AND THIYAM GENERAL⁴ ^{1&2} DEPARTMENT OF CLOTHING & TEXTILES, ^{3&4}DEPARTMENT OF BIOLOGICAL SCIENCES, G.B.P.U.A. & T. PANTNAGAR, UDHAM SINGH NAGAR

In this era of consumer awareness regarding sustainable products due to environmental regulations; natural dyes are regaining their importance against synthetic dyes as they are considered eco-friendly being renewable, biodegradable and skin friendly. New sources of natural pigments are getting focus in research areas due to limited availability, low yield and overexploitation of natural plant resources. To overcome this problem, exploitation of microorganisms such as fungi, bacteria and algae has gained interest to diversify their potential use in textile coloration. These microbes are fast growing and production is economical. In this study fungal pigment obtained from *Talaromyces purpurogenus* sp was used for dyeing of silk fabric and natural mordant such as pomegranate rind was optimized using Box and Bhenkon Design Expert Software. Silk fabric was pre-mordanted with different combinations of mordant concentrations, mordanting time and mordanting temperature. Mordanting parameters were optimized on the basis of colour strength, percent absorption and washing fastness properties. After premordanting the silk fabric was dyed using *Talaromyces purpurogenus* pigment solution (5 pH) at 80° C temperature for 60 minutes. The highest percent absorption and colour fastness was observed at 5g mordant concentration, 55° C and 37 minutes time duration. Color strength, percent absorption and fastness properties (washing, rubbing and light) were investigated. The washing and rubbing fastness ratings of all dyed silk fabric samples were in the range of very good to excellent level. **Keywords**: *Talaromyces purpurogenus*, mordant, natural dyeing, colour fastness properties, Design Expert Software.

PHYSICAL PARAMETERS AS INDICATORS OF SEED MATURITY IN *RHODODENDRON CAMPANULATUM* D.DON IN KUMAUN REGION OF UTTARAKHAND" BHAWNA TEWARI & ASHISH TEWARI

DEPARTMENT OF FORESTRY AND ENVIRONMENTAL SCIENCE, KUMAUN UNIVERSITY, NAINITAL

Himalayas are warming more than the global average rate. Temperature rise of $1-2^{\circ}C$ will impact most of the ecosystem and landscapes. Among various species of the region R. arboreum is perhaps the most studied species in the recent past due to evident changes in its phenophases but such kind of studies are very scanty for R. campanulatum (3000-3600 m) an important under canopy tree species of Central Himalayan Region at higher elevation. We hypothesize that temperature rise in the region may shifts in timing of capsule/seed maturation of the selected species which can affect the germination and regeneration of the species. The main aim of the study was to assess the impact of climate change on the time of flowering, capsule/seed maturation, germination and viability in Rhododendron campanulatum. Two sites for Rhododendron campanulatum were located in Munshiyari; site I at 3000 m altitude between 30°, 03' N latitude 80°, 13´ E longitudes at North eastern aspect and site II at 3200 m between 30°, 03´ N latitude 80°, 13´ E longitudes at North eastern aspect. The initiation of flowering observed in 2nd week of April and flowering completes during 3rd week of May. The capsules of R. campanulatum were collected at ten days interval from the month of November up to the availability of capsules from selected sites. The number of seed per capsule was ranged between 1000 and 1100. Germination was counted when visible radical had developed. For viability retention test capsules collected at full maturity were stored in plastic bags at room temperature. The viability was tested after every 30 days till viability ended. The results showed that the color of capsule was initially green and finally turned brown. The seed moisture content (26.3 \pm 2%) coincided with maximum germination in *R. campanulatum*. Decline in fresh weight moisture content percent from maturing seeds is closely related to seed maturity. The seed moisture content was negatively correlated with germination in R. campanulatum. The seeds remain viable for approximately 10 months and the viability decreases gradually. Key words: Moisture content, Germination, viability, phenology, climate change

GENOTYPIC VARIABILITY, PATH COEFFICIENT ANALYSIS AND CORRELATION STUDY AMONG QUANTITATIVE AND QUALITATIVE TRAITS OF SPEARMINT (*MENTHA SPICATA* L.)

DIVYA ^{*, 1}, K. T. VENKATESHA ¹, GUNJAN BHATT¹, VED RAM SINGH², RAJENDRA CHANDRA PADALIA¹, RAKESH KUMAR UPADHYAY¹,

¹CENTRAL INSTITUTE OF MEDICINAL AND AROMATIC PLANTS (CSIR- CIMAP), RESEARCH CENTRE, PANTNAGAR, P.O. - DAIRY FARM NAGLA, UDHAM SINGH NAGAR, UTTARAKHAND-263149, INDIA. ² CSIR-CENTRAL INSTITUTE OF MEDICINAL AND AROMATIC PLANTS, P.O. CIMAP, LUCKNOW-226015, UTTAR PRADESH, INDIA.

An investigation was carried out to assess the genetic variability, genetic divergence and association of pheno-morphic and agronomic traits along with major chemical constituents of essential oil in 41 accessions of spearmint (*Mentha spicata* L.). Highly significant differences were noted for all 10 economic traits indicating the existence of considerable genetic variability among 41 accessions. High heritability (h^2) and high genetic advance was noted for herb yield (120.64 %). On the basis of D² values, all 41 accessions were grouped into six diverse clusters. The cluster-I was largest group which consist of 20 accessions. A significant and positive correlation was observed for plant height with herb yield (0.58 * *; ** = significant at 1% probability level). The herb yield showed a highest direct effect (0.194) for oil yield. According to results, a significant genetic variability was present among 41 accessions. Simple selection can be employed to improve essential oil content. More importance should be given to plant height, leaf length, leaf width and herb yield during selection to improve essential oil yield in spearmint.

Key words: Correlation, Genetic divergence, Genotypic variance, Heritability,

EFFECT OF ADDITION OF TURMERIC (CURCUMA LONGA) POWDER AS A FEED ADDITIVE ON CERTAIN BLOOD BIOCHEMICAL PARAMETERS OF COMMERCIAL BROILER CHICKEN

D. CHOUDHURY¹, J. D. MAHANTA², D. SAPCOTA³ AND B. SAIKIA⁴

^{1, 3, 4}DEPARTMENT OF POULTRY SCIENCE, COLLEGE OF VETERINARY SCIENCE, ASSAM AGRICULTURAL UNIVERSITY, KHANAPARA, GUWAHATI-781022, ASSAM, INDIA,

²DEPARTMENT OF POULTRY SCIENCE, COLLEGE OF VETERINARY SCIENCE, ASSAM AGRICULTURAL UNIVERSITY, KHANAPARA, GUWAHATI-781022, ASSAM, INDIA.

The present experiment was aimed to study the effect of dietary supplementation of turmeric (Curcuma longa) powder on certain serum biochemical parameters of commercial broiler chicken. A total of 144 day-old commercial broiler chicks (Cobb 400) from a single hatch were procured and randomly divided into four groups viz. T0, T1, T2 and T3 consisting of 36 number of birds in each group. The chicks were wing banded and reared under uniform managemental practices. The birds under T0 group (control) were offered basal diet without turmeric powder. The birds under T1, T2 and T3 groups were fed basal diet supplemented turmeric powder at the rate of 0.25, 0.50 and 0.75% (on dry matter basis), respectively. At the end of 6 weeks, 5ml of blood was collected aseptically from randomly selected five birds from each group. Serum samples were separated and studied for Serum Glucose, Total Cholesterol, Triglycerides, High Density Lipoprotein (HDL), Low Density Lipoprotein (LDL), Serum Alanine Transaminase (ALT), Glutathione peroxidase (GPx). The values of all the blood biochemical parameters (total serum cholesterol, HDL, LDL and ALT) except serum glucose, triglycerides and GPx recorded in the present study differed significantly among the different experimental groups. The total serum cholesterol recorded was significantly $(P \le 0.01)$ in T3 and T2 (140.97 and 148.24 mg/dl) group as compared to T0 and T1 group (158.87 and 160.83 mg/dl). The values of HDL in serum were found significantly (P≤0.01) higher in T3 and T2 group (119.22 and 105.68 mg/dl) compared to T0 in LDL concentration in comparison to the control untreated group. The values of ALT showed significantly ($P \le 0.01$) lower concentration in all the three turmeric treated groups (0.25, 0.50 and 0.75%) as compared to the untreated group (0.00%). All the blood lipid metabolites (Cholesterol, HDL and LDL) except triglycerides were significantly (P≤0.05) improved due to dietary supplementation of turmeric powder in broiler chicken indicating that turmeric powder has certain hypolipidaemic action on broiler production.

Key words: turmeric powder, biochemical, parameters, broiler

DIVERSITY OF AQUATIC HYPHOMYCETES FROM NANDHAUR RIVER (UTTARAKHAND)

SAIMA ALTAF, SARASWATI BISHT, RUCHI JALAL, ANJALI TIWARI

DEPARTMENT OF BOTANY, I.P.G.G.P.G. COLLEGE OF COMMERCE, HALDWANI (KUMAUN UNIVERSITY, NAINITAL)

Aquatic hyphomycetes are the asexually reproducing conidial fungi that grow on decaying leaves, twigs and other plant parts submerged in the fresh water bodies, which were also named as Ingoldian fungi after the name of C.T. Ingold, who discovered them for the first time. They are usually characterized by different shapes of conidia like tetraradiate, triradiate, multiradiate, crescent shaped, spherical, elongated, helical conidia etc. This important fungal group plays non-compromising role in the balancing of ecosystem, continuity of trophic chain, cycling of nutrients, degradation of organic pollutants, monitoring of water pollution etc. These fungi secrete digestive enzymes and make the dead plant parts more nutritious and palatable to the detritus eating invertebrates. Due to their immense importance in aquatic biology, these fungi need to be explored from new regions. Therefore, the present work is undertaken to explore these fungi from Nandhaur River, an unexplored fresh water body flowing through foothill region of Kumaun Himalaya (Uttarakhand). The river is rich in its mycofloral diversity and substrate pool with low to moderate temperature from uphill to downstream. Submerged decomposed leaf litter and foam samples were collected periodically and brought to laboratory for further processing, incubation and sporulation. Altogether 14 species were isolated and identified. Since aquatic hyphomycetes preferably grow in cold waters and are less reported from polluted conditions, their rich diversity indicates that this river is still less polluted and free from anthropogenic influences. **Key words:** Aquatic hyphomycetes, diversity, Nandhaur River.

PREVALENCE OF SCLEROTINIA STEM ROT OF RAPESEED-MUSTARD IN DIFFERENT DISTRICT OF UTTAR PRADESH AND RAJASTHAN

ASMA NAZ* AND R.U. KHAN

DEPARTMENT OF PLANT PROTECTION, FACULTY OF AGRICULTURAL SCIENCES, ALIGARH MUSLIM UNIVERSITY, ALIGARH, UTTAR PRADESH

An extensive survey was conducted on mustard crop during rabi season 2014-15 and 2015-16 at farmers fields in different districts of Uttar Pradesh and Rajasthan to note the incidence of Sclerotinia rot caused by Sclerotinia sclerotiorum. Out of one hundred and twenty five fields from all villages surveyed in five districts, the maximum percent disease incidence was found in Agra (37.43%) followed by Hathras (37.33%), Mathura (28.87%), Bharatpur (24.56%) and Aligarh (21.27%). All cultivars grown by farmers were found more or less susceptible to stem rot, disease incidence ranging from 7.96 to 71.70%. The maximum disease incidence was noted in Varuna (71.70%), however, the incidence was minimum in 5222 cultivar (7.96%). It was reported from the study that the cultivars grown in last week of October and first week of November showed less disease incidence, whereas disease incidence was high, when the cultivars were sown in second and third week of October.

Key words: - Mustard, Sclerotinia sclerotiorum, Survey, Disease incidence

VARIATIONS IN CHLOROPHYLL CONTENT OF DIFFERENT MAIZE GENOTYPES IN RESPONSE TO MAIZE STEM BORER

TANMAYA KUMAR BHOI^{*}, HEMANT KUMAR, IPSITA SAMAL, NEHA TRIVEDI AND MUKESH KUMAR DHILLON DIVISION OF ENTOMOLOGY, ICAR-INDIAN AGRICULTURAL RESEARCH INSTITUTE, NEW DELHI

Considering that the damage caused by phytophagous insects can alter the chlorophyll content of plants. In this paper, relationship between insect damage and the chlorophyll content of different genotypes of maize plant was investigated through DMSO (Dimethyl-sulphoxide) method. Six genotypes of maize were taken CPM 8, CPM 13, CPM 15, CPM 18, CML 345 (resistant check), and Basi Local (susceptible check). The total chlorophyll content in test maize genotypes CPM 13, CPM 15, CPM 18 and CPM 8 was found significantly lower than in susceptible check, Basi Local and higher than in CML 345 both under *C. partellus* damaged and healthy conditions. However, it decreased across all the test maize genotypes in response to damage by *C. partellus*. The feeding by insect pests mainly induces biochemical and physiological changes in the host plants and affect the photosynthetic activity of host plants, thus having implications for growth and production potential of maize plants which show resistance to insect.

Key words: Chlorophyll, DMSO, Basi local, Resistant, Suceptible.

WATER RELATIONS OF TREE SPECIES IN THE HIMALAYAN REGION OF UTTARAKHAND" ASHISH TEWARI¹, SHRUTI SHAH¹ & NANDAN SINGH¹

DEPARTMENT OF FORESTRY & ENVIRONMENTAL SCIENCE, KUMAUN UNIVERSITY, NAINITAL

The treeline of the Himalayan region are highest in the northern hemisphere, therefore trees occurring there experience a different physical environment than treelines of other mountain regions. There is concentrated rainfall in the western Himalaya during monsoon from mid June to mid September. Such concentrated warm season rainfall and the subsequent 8-9months of drought are likely to have profound effects on plant adaptation and ecosystem processes. The Himalayan treeline species have generally not been studied for the impact of drought and its possible repercussions on tree phenology and physiology. In the present study we have tried to assess the level of water stress that is encountered by the major treeline species Quercus semecarpifolia Sm., Abies spectabilis D. Don., Betula utilis D. Don Rhododendron arboreum Wall and R. campanulatum D.Don of western Himalayan region. The study was carried out at Tungnath treeline situated at 30°49'22" N latitude and of 32°79'21' 47" E longitude occurs between 3200 and 3560m asl elevation. Tree water potential (Ψ), Pressure volume curves and leaf conductance were measured on five representative trees seasonally. The water potential (Ψ) was measured at predawn (Ψ_{PD}) (5.30- 6.30 A.M.) and in the midday (1.30- 2.30 pm) (Ψ_{MD}). In the selected species the tree water potential (Ψ) varied significantly across species and seasons (P<0.01). Across all seasons and the two study years, the Ψ_{pd} of all species remained above -1.0 MPa indicating the absence of severe stress. Minimum values of Ψ_{pd} for all species were observed during the summer season followed by the comparatively dry autumn season. The lowest Ψ_{md} were generally encountered during summer and winter seasons with values ranging between -0.88±0.02 MPa (B. utilis) and -1.95± 0.04 MPa (A. spectabilis). The magnitude of diurnal change across all species was maximum during the growing season from spring to autumn. Morning conductance varied significantly across seasons (P<0.01) but there was no significant variation across species. All the treeline species maintained a high rate of leaf conductance during late spring and summer season. The morning leaf conductance across all seasons and species ranged between 28.75 ± 1.45 and 329.2 ± 8.98 m mol m⁻² sec⁻¹. To conclude, it is apparent from the study that water potential does not reach lethal level to curtail phenological and physiological activities in selected treeline species. All the species could reduce their osmotic potential and maintain a favorable water potential gradient from the soil to the tree which assists in absorption of water particularly during the growing season. Among studied species R. campanulatum has a weaker osmotic adjusting capacity and deciduous B. utilis makes maximum use of the period during which it has leaves as evident from its higher leaf conductance. Theses high altitude species are less stressed than the mid altitudinal species like Q. leucotrichophora and Pinus roxburghii.

Key words: Water Potential, Pressure Volume Curve, Leaf Conductance

MOLECULAR BASIS OF WING POLYMORPHISM IN INSECTS

TANMAYA KUMAR BHOIA , IPSITA SAMALA AND SWAPNALISHA MOHAPATRA $^{\rm B}$

^ADIVISION OF ENTOMOLOGY, ICAR-INDIAN AGRICULTURAL RESEARCH INSTITUTE, NEW DELHI DEAPARTMENT OF ENTOMOLOGY, ICAR- ODISHA UNIVERSITY OF AGRICULTURE AND TECHNOLOGY, BHUBANESWAR, ODISHA

Insects represent a major life form on earth. Nearly one million insect species have been discovered which comprises 75% of all the recorded animal species. This biological success is majorly accredited to the enormous diversity of their size, body structure and flying capacity. Flight polymorphisms in insects, in which both flight-capable and flight-incapable morphs are produced, are attractive model systems for understanding the adaptive significance of dispersal in natural populations. Wing form is often determined by an

environmentally sensitive switch at certain sensitive stages that specifies the development of either the LW (Long Wing) or SW (Short Wing) /wingless morph. Prior to wing-morph determination, the insect first perceives surrounding environmental cues and then converts such cues into intercellular signals during the sensitive period of wing-morph switching. Afterward, cellular signalling guides the developmental trajectory of certain tissues (e.g. wing buds and flight muscles) and eventually results in the corresponding adult phenotypes. With the advent of high-throughput sequencing coupled with functional genomics provides powerful genetic tools for future insights into the molecular bases underlying wing polymorphism in insects. Endocrine mechanisms controlling the development and reproduction of flight-capable and flightless morphs of wing-polymorphic insects have been reported previously that Juvenile Hormone (JH) and Ecdysone Hormone (EDH) regulates the polymorphism by controlling the expression of traits that differ between the morphs. The insulin/insulin-like growth factor signalling (IIS) pathway is an evolutionarily conserved nutrient-sensing pathway that modulates growth and development in metazoans. In the planthopper Nilaparvata lugens, two insulin receptors (InR1 and InR2) act as a switch to determine the development of alternative wing morphs via regulating activity of the Forkhead transcription factor subgroup O (FoxO). Epigenetic phenomena have positioned in insect for the study of wing polymorphism. The discovery of a functional DNA methylation system, functional small RNA system, and expanded set of chromatin modifying genes provides a platform for analysing these pathways. Although the advent of high-throughput sequencing coupled with functional genomics has dramatically broadened our knowledge of the molecular basis of insect wing polymorphism but we still have only scratched the surface; so much more needs to be discovered. Key words: Morphs, polymorphism, DNA methylation, insulin receptors, JH, EDH and ISS.

EFFICACY OF ENEROFLOXACIN FOR THERAPEUTIC MANAGEMENT OF CUTANEOUS FORM OF PIGEON POX K. P SINGH¹*, PRANEETA SINGH², R.V. SINGH³, R.A. SIDDIOUE⁴ AND S.K. SINGH⁵

GOVERNMENT VETERINARY HOSPITAL, DEORANIAN, BAREILLY, DEPARTMENT OF ANIMAL HUSBANDRY, UTTAR PRADESH. INDIA

²DEPARTMENT OF LIVESTOCK PRODUCT TECHNOLOGY, C.V.A.SC., GBPUAT, PANTNAGAR, U.S.NAGAR, UTTRAKHAND

³ DEPARTMENT OF PHARMACOLOGY, BHAVDIYA INSTITUTE OF PHARMACEUTICAL SCIENCES AND RESEARCH, AYODHYA, UTTAR PRADESH.

⁴ DEPARTMENT OF VETERINARY PHYSIOLOGY AND BIOCHEMISTRY, COVAS, SVPUAT, MERRUT, U.P. ⁵GOVERNMENT VETERINARY HOSPITAL, AELYIA, SITAPUR, DEPARTMENT OF ANIMAL HUSBANDRY, UTTAR PRADESH

Pigeon Pox is one of the most commonly reported infectious and contagious disease of the pigeons. Cutaneous form of pigeon pox was observed in a flock of 98 pigeons in Deoranian, Bareilly, Uttar Pradesh. Clinical examination of all the 98 pigeons of this flock was revealed that, greyish nodular eruptions were present over the beak, around the eyes, over the legs and peri cloacal region. The nodular eruptions showed papules, crust and discharge. All the affected pigeons were dull and depressed. All the 98 pigeons were randomly divided into two groups i.e. group 1 (n = 88) and group 2 (n = 10). In group-1 (n = 88) all the pigeons were treated with enerofloxacin @ 05 mg/ Kg body weight orally twice a day and oral multivitamin and liver tonics supplementation. Whereas, in group- 2 (10) all the pigeons were treated with only multivitamin and liver tonics. Skin lesions of all the 98 pigeons of both groups were treated with topical application of povidone iodine. The clinical efficacy was assessed by gradual clinical improvement in the lesions and physical appearance. In group-1(n= 88) enerofloxacin treated group, out of 88 pigeons, 74 (84.09 %) recovered completely after 15 days of therapy and 14 (15.90 %) died during course of treatment. In group-2 (n= 10) in multivitamin and liver tonics supplemented groups, out of 10 pigeons, 2 (20 %) recovered after 15 days of therapies and 8 pigeons (80 %) died during the course of treatment. So, in the present study it was concluded that enerofloxacin is highly effective (84.09 %) for therapeutic management of cutaneous form of pigeon pox.

Key words: Enerofloxacin; pigeon; pox; treatment

A REVIEW UPON THE PREPARATION OF RHODODENDRON SOUASH AND ITS BENEFIT TO HUMAN LIFE SAMBIDDHA THAPA, BASANTA PANDEY, SANGAM ADHIKARI, DR. ANKIT KUMAR, SUDEEP PATHAK DEPARTMENT OF AGRICULTURE & FORESTRY, TULA'S INSTITUTE, DEHRADUN

Rhododendron arboreum is one of the renowned plant species of Rhododendren & is known for its bright beautiful red bell shaped flower which is rich in medicinal properties. Flowers & Leaves are mostly used for the medicinal purpose. Squash of Rhododendron is very popular & its preparation is carried out in 2 ways i.e. traditional & improvised way. In traditional way, rhododendren petals and sugar (both in equal amount) are boiled till petals are bleached out. While in improvised case, rhododendron petals are treated with water at 80°C for 20 mins & then left for 3 hours followed by filtration & adding of sugar. For the higher yield of juice extraction, 250g of petal were treated with 30% water. Both sugar & honey based squash are produced commercially. Rhododendron squash has incredible health benefits such as prevent cancer, treat diseases etc. Thus, following review focus on the preparation of squash & its medicinal uses. Keywords: Rhododendron arboreum, squash, traditional, improvised

GENOTYPE BY TRAIT BIPLOT ANALYSIS FOR YIELD AND NUTRITIONAL TRAITS IN PEARL MILLET (PENNISETUM GLAUCUM (L.) R. BR.)

V. PRIYANKA^{*1}, P. SHANTHI², D. M. REDDY³ AND B. RAVINDRA REDDY⁴

*1, 2, 3 DEPT. OF GENETICS & PLANT BREEDING, S.V. AGRICULTURAL COLLEGE, TIRUPATI - 517 501, ACHARYA N.G. RANGA AGRICULTURAL UNIVERSITY, LAM, GUNTUR (ANDHRA PRADESH).

4 DEPARTMENT OF STATISTICS AND MATHEMATICS, S.V. AGRICULTURAL COLLEGE, TIRUPATI - 517 501, ACHARYA N.G. RANGA AGRICULTURAL UNIVERSITY, LAM. GUNTUR (ANDHRA PRADESH).

Forty two genotypes of pearl millet were evaluated in randomized block design for three nutritional and 12 yield related traits to estimate genetic parameters like genetic variability, heritability and genetic advance as a percentage of mean, genetic divergence and genotype by trait biplot analysis. Among these significant characters, the genetic advance as percent of mean along with higher values of heritability, GCV and PCV estimates were maximum for grain yield plot⁻¹, green fodder yield plot⁻¹, iron content, protein content, green fodder yield plant⁻¹ and zinc content indicating the presence of additive gene action. The genotypes ICHiFe-18, ICHiFe-19, ICHiFe-17, ICHiFe-13,

ICHiFe-3, ICHiFe-21, ATP-2 and ATP-12 have displayed the maximum *per se* performance for most of the nutritional traits. Based on Genotype by Trait biplot analysis, the genotypes ICHiFe-18, ICHiFe-12, ATP-3, ICHiFe-21, ATP-2, ICHiFe-20, ATP-4, ATP-8, ATP-15, ICHiFe-14, ICHiFe-4, ICHiFe-2 and ICHiFe-5 showed superior performance for nutritional traits. The traits *viz.*, plant height, 1000 grain weight, panicle length, panicle girth, number of productive tillers plant⁻¹, green fodder yield plant⁻¹, harvest index and protein content were identified as important traits for the improvement of high yield as well as nutritional quality in grain and considered as key components during the selection. Based on the D² divergence analysis, all the 42 genotypes of pearl millet were grouped into ten clusters using Tocher's method and the crosses viz., ATP-2 x ATP-8 (cluster III x cluster VII), ICHiFe-3 x ATP-4 (cluster III x cluster V), ATP- 2 x ICHiFe-20 (cluster III x cluster VI) for high yield and nutritional traits are considered for obtaining a wide spectrum of variation among the segregants and could be utilized for future breeding of nutritionally rich genotypes with high grain and fodder yields to ensure food and nutritional security.

Key words: Pearl millet, Genotype by Trait biplot analysis, Iron and Zinc content, Protein content, nutritional security.

STUDY ON THE DIVERGENCE ANALYSIS OF CHICKPEA(CICER ARIETINUM L.) AND ITS MOLECULAR CHARACTERIZATION USING MICROSATELLITE MARKER

¹RAHUL ANAND^{*} AND ¹MITHILESH KUMAR

DEPARTMENT OF AGRICULTURAL BIOTECHNOLOGY AND MOLECULAR BIOLOGY, DR. RAJENDRA PRASAD CENTRAL AGRICULTURAL UNIVERSITY, PUSA, BIHAR

Twenty four genotypes were chosen for morphological and eighteen genotypes for molecular characterization of chickpea. The highest inter-cluster distance was observed between cluster I and V on the basis of their genetic distances. Cluster II showed maximum cluster mean values for yield per plot (538) and attributing characters like plant height (40.20); number of primary branches (3.05) and pods per plant (15.13) by cluster I, number of seeds per pod (1.59) by cluster III and 100 seed weight by cluster V. Molecular markers generated a total of 77 shared and 50 unique allelic variants in the form of amplified products. The polymorphism information content values revealing allele diversity and frequency among the chickpea genotypes varied from 0.549 in H2A02 to 0.994 in H2E13. Eight SSR primers namely, H1A06, H1I24, H2A11, H2I10, H2J10, H2J11, H2J19, and H3A07 appeared to be highly polymorphic and informative. The polymorphism percent to be the maximum in the case of H2I01 (71.42%). By drawing the twenty-six phenon similarity units, the entries were basically divided into six groups. There was 16.66% similarity between pattern based on morphological and molecular characterization.

Keywords- Allelic variants, Cluster, Morphological, Molecular and Polymorphic

AN ETHNOBOTANICAL SURVEY OF MEDICINALLY IMPORTANT WILD PLANTS OF DISTRICT NAINITAL (KUMAUN HIMALAYA)

HARSHI JOSHI

DEPARTMENT OF BOTANY P.N.G.P.G COLLEGE RAMNAGAR, NAINITAL

Wild plants are uncultivated plants found in the wild forms that have nutritive values and can be used for fulfilling the dietary requirements. These plants have important contributions to the food security and providing the supplement foods and generating income opportunity to the communities. However these plants are often ignored in the process of biodiversity conservation and economic development and its nutritive and medicinal importance is unknown. The present investigation deals with the preliminary survey conducted during august-october 2019 in Nainital to collect identify and record the wild plants used medicinally. Many researchers have conducted studies on the wild plants their family names habit plant parts and uses . This paper has attempted to compile and analyze the information on wild plants their medicinal values and abundance of these plants in nature .Tinospora cordifolia (Thunb.)Miers(Giloi),Murraya koenigii (linn.)Spreng(Kari patta),Rubus fruticosus L.(blackberries),Solanum nigrum L.(Makoi),Boerhavia L.(Purnava),Canabis sativa L.(Bhang),Ficus roxburguii Lour.(Timla) ,Phyllantus emblica L.(Amla) ,Ziziphys mauritiana Lam. (Ber),Azadiracta indica A.Juss. (Neem),Aegle marmelos Corr.(Bel)Origanum vulgareL.(Ban Tulsi),Opuntia dillenii Haw.(Nagphani),Aesculus indica Colebr.ex Comb.(Panger),Berberis vulgarisL.(Kilmora),Syzygium cumini(L.) (Jamun),Morella esculenta(Kafal)are the most dominating medicinally important wild plants in the region.The present study will be useful with particular emphasis with medicinal importance of wild plants.Due to over exploitation these plants may not be freely available in future therefore conservation of these wild plants will help to enhance and maintain the regional biodiversity.

Keywords- Wild plants, medicinal, biodiversity, ethnobotany, nutrition, conservation

QUANTITATIVE AND QUALITATIVE ASSESSMENT OF POLLINATION SPECTRUM ASSOCIATED WITH AESCULUS INDICA COLEBR. (INDIAN HORSE-CHESTNUT PLANT)

AMAN VERMA¹, MANOJ KUMAR ARYA¹ INSECT BIODIVERSITY LABORATORY, DEPARTMENT OF ZOOLOGY, D.S.B. CAMPUS, KUMAUN UNIVERSITY, NAINITAL-263002 (UTTARAKHAND), INDIA

The present research aimed to study the pollination biology and conservation of *Aesculus indica* Colebr. growing in Kumaon Himalaya. Survey was carried out in a temperate forest ecosystem of Lohaghat, district Champawat, Uttarakhand, India. Insect pollinators as a factor affecting the reproductive success of *Aesculus indica* were also studied. In total, 18 species of which 5 species belonged to the order Hymenoptera and 13 species belonged to the order Lepidoptera. Experimentally, it was also found that *Aesculus indica* is mainly insect pollinated plant and is largely dependent on insects rather than wind for its pollination. *Aesculus indica* is a narrow endemic plant and along with its preservation, conservation of its putative pollinators is also essential.

Keywords: Conservation, IUCN, Paangar, Reproduction

EFFECT OF MANURES, HYDROGEL AND TRICHODERMA ON DIRECT SEEDED RICE UNDER RAINFED CONDITION ARDITH SANKAR* AND AVIJIT SEN

DEPARTMENT OF AGRONOMY, INSTITUTE OF AGRICULTURAL SCIENCES, BANARAS HINDU UNIVERSITY, VARANASI-221 005

Water availability is one of the most important inputs which contribute to the growth and productivity of rice crop. Rice faces serious challenges in cultivation with the decreasing water availability. Under these circumstances, direct seeded rice (DSR) is an emerging option and is becoming very popular nowadays. Variability of the monsoons, uncertain and uneven precipitation are some major constraints for crop production under rainfed condition. Increasing the productivity of water used in agriculture is essential to meet goals of food and nutritional security. Nutrient uptake which is governed by water and nutrient availability is often hindered due to the limitation of moisture. In view of the above, an experiment was conducted in the *kharif* seasons of 2016 and 2017 in the Agricultural Research Farm, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi to find out the possible effect of organics, hydrogel and microbes in different combination on the two varieties of rice, viz. DRR 42 and IR 64. The trial was a factorial experiment in randomized complete block design with four replications. DRR 42, a drought tolerant variety, produced higher grain yield (3.26 t ha⁻¹) and was significantly superior to IR64 (0.50 kg m⁻³). All the soil and seed treatments cumulatively exhibited higher values than control in grain yield, straw yield, panicles/m² and water holding capacity of the soil. D-18 compost and *Trichoderma* showed highest grain yield (3.53 t ha⁻¹), straw yield (5.28 t ha⁻¹), panicles m⁻² (254.75). It was further observed that D-18 compost (soil application) along with *Trichoderma* (seed treatment) displayed the highest water productivity (0.58 kg m⁻³) among all the treatments. Thus, the present investigation reveals that DRR 42 when treated with D-18 compost and *Trichoderma* can perform better under rainfed condition.

Keywords: Compost, FYM, hydrogel, Trichoderma sp., rainfed, water productivity

MODULATION OF GROWTH, YIELD, AND ZINC STATUS IN WHEAT BY ZINC SOLUBILIZING BACTERIA NITESH KUMAR SINGH AND A. P. SINGH

DEPARTMENT OF SOIL SCIENCE AND AGRICULTURAL CHEMISTRY, INSTITUTE OF AGRICULTURAL SCIENCES, BANARAS HINDU UNIVERSITY, VARANASI-221005, UTTAR PRADESH, INDIA

Zinc deficiency is a common problem in plants and animals. Pot experiments were conducted in Banaras Hindu University during *rabi* seasons of 2016 and 2017 to study the effect of zinc solubilizing bacteria on growth, yield, and zinc content of wheat grown in alluvial soil of Varanasi. Treatments were made with three zinc sources (zinc sulphate, zinc oxide, and zinc carbonate) with two doses (1 and 2 mg pot⁻¹), 100% recommended dose of zinc, and three selected zinc solubilizing bacterial strains (ZSB₁, ZSB₂, and ZSB₃). All the selected bacterial strains were also positive for various plant growth promoting activities like organic acids and IAA production and halo zone formation. Zinc solubilization ability was considerably higher in ZSB₂ than the other strains. Results revealed that 2 mg zinc sulphate with ZSB₂ gave better results in maximum growth parameters (plant height, no. of leaves, chlorophyll content, etc.) and grain and straw yield followed by other zinc sources (zinc oxide and zinc carbonate) combined with ZSB₂. Molecular studies revealed the bacterial strains as *Bacillus* sp. The study is an indication that inoculation of zinc solubilizing bacteria in wheat is a holistic approach to achieve the desired goals of sustainable production and overcome the challenges of malnutrition. Biological properties of soil also improved upon sustainable management of zinc and zinc solubilizing microbes.

Key words: Zinc solubilizing bacteria, Zinc sources, Zinc solubilization ability, Wheat

GENETIC DIVERSITY OF *SPODOPTERALITURA*FABRICIUS POPULATIONS COLLECTED FROM DIFFERENT AGRO-CLIMATIC ZONES OF INDIA USING MITOCHONDRIAL CYTOCHROME C OXIDASE SUBUNIT I SABUJ GANGULY^{*} AND C. P. SRIVASTAVA

DEPARTMENT OF ENTOMOLOGY AND AGRICULTURAL ZOOLOGY, INSTITUTE OF AGRICULTURAL SCIENCES, BANARAS HINDU UNIVERSITY, VARANASI 221005, UTTAR PRADESH, INDIA.

Spodopteralitura Fab. (Noctuidae; Lepidoptera), is a polyphagous defoliator insect pest and is delineated to attack over 60 crop species in India. Its wide range of dispersion and presence in crop ecosystems belonging to almost all agro-climatic conditions has continuously exposed it to several biotic and abiotic factors and thus has coerced it to show differential susceptibility against insecticides and climatic conditions. This brings the question to whether there is sub-speciation or cryptic species formation under the peer pressure. The present study deals with molecular diversity data and phylogenetic relationship of *S. litura* presenting 21 locations across 10 different agroclimatic zones of India. Alignment of the mtCOI sequences evealed that among the 21 populations 9 polymorphic sites were present, of which 8 were transitional and 1 transversional substitution. The pair-wise genetic distance (*p*-distance) of *S. litura* populations ranged from 0.00 to 0.013 with highest genetic distance evident between Rasulpur (West Bengal) and Varanasi (Uttar Pradesh) populations. Composition of different nucleotide bases in the COX-1 gene sequences of 21 populations revealed that mtCOI is A-T biased constituting about 69.2 to 70.2 per cent. The maximum likelihood (ML) tree produced distinct clades indicating possibility of emerging host associated genetic differences in S. liturapopulations of India. The level of genetic variation detected between the *S. litura* populations with mtDNA-PCR analysis suggests that it is an efficient marker technology for delineating genetic relationships among populations and estimating genetic diversity.

Keywords: Spodopteralitura, genetic diversity, mtCOI, phylogeny, p-distance, ML tree

IDENTIFYING OF VARIOUS CONSTRAINTS FACED BY THE FARMERS ON PULSE CULTIVATION IN NORTHERN PART OF WEST BENGAL

BIMAN MAITY, TARUN KUMAR DAS AND BABLU GANGULY

DEPARTMENT OF AGRICULTURAL EXTENSION

UTTAR BANGA KRISHI VISWAVIDYALAYA, PUNDIBARI, COOCH BEHAR, WEST BENGAL-736165

Pulse is a leguminous crop and fixes nitrogen through its rhizomes which improves the soil fertility and makes soil more permeable. In India, the production of pulse crop is lesser as compare to the rate of consumption due to its various constraints in production technology. In rural areas, majority of the peoples depends on pulses and used for their daily livelihood food items. Pulses are considered as a major

source of protein, fibers, vitamins and minerals for a huge section for the small, marginal, poor, backward classes of the traditionally vegetarian population. Pulse is also called 'poor man's meat'. United Nation declared that 2016 is the 'International Year of Pulse'. The study was conducted in four villages of Northern part in West Bengal. The total sample size of the study was 100. An interview schedule was prepared to collect the data and collected data was analyzed through statistical tools. The results reveals that the awareness level of pulse cultivation among the respondents of the study area is less due to various constraints such as climatic constraints, managerial constraints, infrastructural constraints, socio-economic constraints, technological constraints, land situational constraints and institutional and policy constraints. The study shows that the interest of the farmers on pulse production also reducing day by day due to adverse climatic condition and they are diverting to other enterprises. Lack of proper connectivity and follow-up between line departments with the pulse grower are one of the lacunas which demotivate the pulse grower in present situation in the study area. Therefore, it is recommended that the line department, universities, NGOs etc. need to take more focus and formulate some appropriate policy to augment the productivity through evolving new technologies, introducing high yielding and resistant varieties, better management practices and good institutional supports to the pulse grower for its prosperity and sustainability. **Key words:** Pulse, Cultivation, Constraint, Connectivity, Farmers

THE MULTIFACETED APPLICATIONS OF IRON OXIDE NANOPARTICLES IN AGRICULTURE. SANGAM ADHIKARI¹, BASANTA PANDEY, SAMBIDDHA THAPA, SUDEEP PATHAK, RICHA RAJPUT DEPARTMENT OF AGRICULTURE AND FORESTY, TULA'S INSTITUTE, DEHRADUN

Particles of any shape ranging 10^{-9} m to 10^{-7} m in dimensions are known as nanoparticles. These have been much of a recent scientific interest as they are, in effect, a bridge between bulk materials and atomic structure. Iron oxide as nanoparticles are mainly found in two forms: magnetite (Fe₂O₄) and its oxidized form maghemite (Fe₂O₃). They are synthesized mostly by co-precipitation (stoichiometric mixture of ferrous and ferric hydrochloride) and also through microemulsions. Generally, in the field of agriculture iron oxide NPs are utilized on multiple levels from fertilization to bioremediation. As per the recent research it has added advantage of increasing the plant root length, increasing plant height, increasing biomass (~33%), SPAD value of plant, regulating phytohormones, regulating antioxidant enzyme activity, increasing chlorophyll content (~10%), increasing seed mass (~7%), iron content(~34%) and also works as the bioremediating agent in reducing toxic concentration of metals in the plants and soil. Iron oxide NPs are basically applied as the Iron Oxide Nano Fertilizer or as foliar spray. They are one of the most preferred NPs because of their biocompatibility and potentially non toxic nature. Because of its magnetic properties it is also in the verse of research on site targeted nano materials in plant physiology. The present work is the summarisation of the previous research work done in the agricultural field utilizing iron oxide nanoparticles to direct towards more advanced agricultural practices.

Keywords: Ironoxide, Nanoparticles, bio-remediation, Crop yield

IMPACT OF GOODS AND SERVICES TAX (GST) ON SHOPKEEPERS OF FOOD AND CLOTHING INDUSTRY SHATAKSHI SEMWAL*, ELLA RANI**

DEPARTMENT OF EXTENSION EDUCATION AND COMMUNICATION MANAGEMENT, I.C. COLLEGE OF HOME SCIENCE, CCSHAU, HISAR

Goods and Services Tax has been a game changer for our Indian Economy with the hope of many ambitious targets. To achieve these goals, strategic undertakings have been done such as demonetization, Make in India and Digital India campaigns. GST is another such concept that was implemented from July 1st, 2017 unifying all the indirect taxes and making India successful in "One Nation One Tax" regime. This research paper uses primary sources of data collected through structured interview schedule. A total of 100 responses were collected in the survey, 50 each from Food and Clothing sections. The results from the survey found that there was no impact on profit and loss conditions of the shopkeepers but they are now facing highly increased tax burden and legal compliances. GST especially in branded and non-branded products had proven to be both profitable and non-profitable for the shopkeepers. Many changes have been constantly made in the GST system to make it simpler but its changing rate slabs is confusing not consumers but also the shopkeepers. The constraints and problems faced by the shopkeepers towards GST implementation revealed that filing GST is complicated and they are now facing more competition in the market. However, it could be concluded that the small and medium shopkeepers are facing an enormous threat from the increase in tax compliance costs which pushes the gross 'end' proces of products.

ASSESSMENT OF FUEL WOOD DIVERSITY, CONSUMPTION AND ITS POTENTIAL FOR AS GREEN MEDICINE IN SEMI ARID REGION, INDIA

SWATI GUPTA** AND POONAM MEHROTRA*

* FACULTY ,DEPARTMENT OF BOTANY, BUNDELKHAND UNIVERSITY JHANSI

****INSTITUTE OF ENVIRONMENT AND DEVE STUDIES, BUNDELKHANDUNIVERSITY, JHANSI**

A cardinal mandate "Partnerships to fight poverty across the world' of United Nations Development Programme is diminishing in monstrous mood due to the accelerating rate of the depletion of this biological diversity. As vegetation, is an integral part of a ecosystem for sustaining life by commanding the resilience and resistance of a ecosystem. By the gradual but stable rate of progress, India has secured a 10th rank with in fasted growing economy and harboring 8.0 % of the biodiversity of the world. The natural wealth of the country which having tremendous potential to alleviate all type of human sufferings ;Emotions(Aesthetic), Economical flaws and Energy requirements. All three E are interdependent . In addition, Energy is one of the critical inputs in the economic development of area . Biomass(charcoal and fuel wood) energy, an universal source of energy especially for rural inhabitants in the country is ruthlessly excavated from current forest and tree cover area for fuel wood requirements of houses in daily life , by both legal or illegal means (pilferage from forests is treated as unrecorded till date)and consequently, vanishing substantial portion of forest resources.Present study was carried out in physical setting of Bundelkhand , in and around of jhansi city , Uttar Pradesh, India , comes under . a semi-arid climate with notorious phenomena drought-like conditions in summer and disastrous floods during the monsoon . The different fuel wood selling shops (wood Tals) surveyed and selected for study. Wood sellers and house holds-users were interviewed. The twenty- two woody species were identified belonging from more than ten diverse taxonomic families, were used as fuel wood by households at rural as well as urban area. Information about the total calorific value of a wood and the assessment of the economic importance of a species

was done. Findings showed that there is broad spectrum of medicinal uses of various fuel wood species reported from study area i.e., cancer, HIV, Diabetic, leprosy, poisonous bites, skin problems etc. A positive correlation was observed between calorific values and green medicine for various disease obtained fuel wood species occurring at study site. The study revealed that felling of small trees for use as fuel wood and collecting head loads of dead wood from forests for personal use as fuel wood was a one of another additional way to disturbing existing vulnerable forest ecosystems of the area. Results convey that If the estimated annual consumption of fuelwood far exceeds then plant diversity-a natural precious green gold may vanished out and this could be depleting the country's forest patrimony. Key wards: Fuel wood, Wood taals, medicinal value, semi arid region

KNOWLEDGE AND ATTITUDE ABOUT OBESITY AND POLYCYSTIC OVARIAN SYNDROME AMONG ADOLSCENTS AISHWARYA V PATIL¹, K V SUDHA² AND DR. PUSHPA BHARATI³

DEPARTMENT OF FOOD SCIENCE AND NUTRITION, COLLEGE OF COMMUNITY SCIENCE, UNIVERSITY OF AGRICULTURAL SCIENCES, DHARWAD.

Adolescence is a unique period where there is a transition from childhood to adulthood. Advancement in modernization and urbanization had changed our lifestyle. This unhealthy lifestyle leads to obesity with increased incidence of health problems. Polycystic Ovarian Syndrome (PCOS) is a condition in which woman has an imbalance of female sex hormones. It is a common health problem among teenagers and young-women. It affects 5% to 10% of women in their reproductive years. Hence the study was undertaken to assess the knowledge and attitude about obesity and PCOS among adolescent girls.

MATERIALS AND METHODS: 30 adolescent girls (14-16y) were selected from krishinagar primary and secondary school, Dharwad, Karnataka. A detailed questionnaire was formulated with general information, anthropometric measurements, nutritional status and knowledge and attitude about obesity and PCOS. Pre and post-knowledge test was assessed for retention and improvement in knowledge by using visual aid. The study revealed that majority of the adolescent girls belonged to underweight (56.66%) followed by normal BMI (40%) and overweight (3.33%). Majority of adolescent's had better knowledge about obesity i.e., 60% girls told that obesity is caused by overeating (100%), consumption fatty foods (96.66%), and eating vegetables and fruits and exercising regularly reduces weight (76.66%). Majority of adolescent's agreed that PCOS patient should consult a physician (73.33%) and tablets can cure PCOS (86.66%). More than half of the adolescent's didn't know that surgery can remove ovarian cyst (63.33%). After the intervention there was a significant increase in knowledge among adolescents girls (t value- 5.80**). Adolescents girls had better knowledge about obesity but had low knowledge on PCOS before intervention. There was increase in knowledge among adolescents after intervention. As obesity and PCOS are linked together, weight loss and maintenance of the body weight can be effective method in reducing the health complications associated with PCOS.

Keywords: Adolescence, obesity, PCOS.

EXPLORING THE ARID UNDERUTILIZED FRUITS FOR FOOD AND NUTRITIONAL SECURITY KALPANA CHOUDHARY*, NIRMAL KUMAR MEENA, SONALI CHOUDHARY** AND VAISHALI GUPTA COLLEGE OF HORTICULTURE AND FORESTRY, AU, KOTA, JHALARAPATAN, JHALAWAR- 326 023 (RAJASTHAN) **YS PARMAR UHF, NONI, SOLAN (HP)

Western desert part of India enriched with various underutilized fruits which are rarely cultivated by the farmers. Though, fruits are not cultivated but traditionally used by the local people. These fruit speciesbestowed with high nutritive and medicinal values. Many indigenous fruit crop species that have been neglected having great potential to augment food and nutraceautical securityfor rural and tribal peoples. Among them, *Ker (Capparis decidua), Pilu(Salvadora oleoides), Khejri (Prosopis cineraria), Phalsa (Grewia subinequalualis), Lasora* or *Goonda (Cordia myxa)*, Jharberi (*Zizyphus nummularia), etc.* are predominant. Owing to their antioxidant activity these fruits, act as a functional foods, which provide healthy substances in addition to calories and minerals. Mature fruits of *Pilu* and *Ker* are rich source of many phytochemicals like carotenoids, phenolic. Ber is richer than apple in their nutritive values such as protein, carotene and vitamin C. Consumption of antioxidant rich food suppresses development of many diseases. The interest in phytochemical content of minor fruit species is increasing in human health. Apart from this, these fruits are used to prepare various processed products like jam, jelly, pickles and many beverages which ensure the round year taste of particular fruit. These processed products are sold by local vendors which generate additional return and secure livelihood.

Keywords: Arid fruits; antioxidants; nutraceuticals; health benefits

EFFECT OF FEEDING TERMITES (<u>NEOTERMES ASSAMENSIS</u>) AS PROTEIN SOURCE ON CARCASS TRAITS OF JAPANESE QUAIL.

NETHEE DEORI¹, REEMA SAIKIA², KASHMIRI BEGUM³

¹DEPARTMENT OF LIVESTOCK PRODUCTION MANAGEMENT, KHALSA COLLEGE OF VETERINARY & ANIMAL SCIENCE, AMRITSAR

^{2,3}DEPARTMENT OF POULTRY SCIENCE, COLLEGE OF VETERINARY SCIENCE, KHANAPARA, GUWAHATI.

A study was conducted with 180 numbers of day old unsexed Japanese quail chicks from a single hatch and was randomly divided into four equal groups i.e. T_0 (control), T_1 (5% dried termite), T_2 (10% dried termite) and T_3 (15% dried termite) containing 45 numbers of chicks in each group which was further subdivided into 3 replicates of 15 chicks in each, to study the effect of termites (*Neotermes assamensis*) as a protein source on the carcass traits of Japanese quails. At the end of experiment, Carcass traits results revealed that dressed weight and dressing percentage differed significantly (P \leq 0.05) among the treatment groups (T₃ and T₀). The per cent yield of cut- parts like neck, wings, back, breast and thighs except drumsticks , did not differ significantly (P>0.05) among the different treatment groups .The physico-chemical properties of Japanese quail meat viz. pH, water holding capacity (WHC) and fibre diameter (FD) from breast muscle were estimated. The water holding capacity and pH of meat showed no significantly (P \leq 0.05) from T₀ and T₁ groups.

Keywords: Carcass Traits, Fibre diameter, Japanese quail, Termites, Water holding capacity.

GENETIC VARIABILITY AND STABILITY ANALYSIS FOR SOME QUANTITATIVE CHARACTERS IN GLADIOLUS (GLADIOLUS GRANDIFLORUS L.)

¹PUSHPENDRA VERTY ²V.M PRASAD AND ³MANOJ NAZIR 1SCHOOL OF AGRICULTURE, ITM, UNIVERSITY GWALIOR 2DEPARTMENT OF HORTICULTURE, SHUATS, ALLAHABAD 3DIRECTORATE OF AGRICULTURE, JAMMU

Experiment on Gladiolus was carried out at Sam Higginbottom University of Agriculture, Technology & Sciences, Prayagraj and Directorate of Agriculture, Research Field (Floriculture) Jammu for two years during 2013-2104 to 2014-2015 in order to study the genetic variability, heritability, genetic advance, correlation coefficient and stability of eighteen quantitative characters in gladiolus. Twenty genotypes of gladiolus were grown in randomized block design (RBD) with three replications at Allahabad & Jammu. Analysis of variance (ANOVA) revealed that Mean square due to treatments were significant for most of the characters in all the four environments except for number of florets open at first, number of shoots per plant, number of leaves per shoot, number of corms per plant for all the four environments and average weight of cormels per plant in (E₂) Jammu. The PCV were higher than GCV for all the character studied for all the environments, indicating high degree of environmental influence. Higher GCV and PCV estimates were found for number of cormels per plant for Prayagraj (E_1 and E_3) and cormels per plant and corm per plant for Jammu (E_2 and E_4). Heritability in broad sense was found to be high for mostly characters studied in all the environments. Low heritability recorded for the characters viz; Diameter of corm Allahabad (E_1) , floret remain open at a time and shoot per plant at Allahabad (E_1) Jammu for the characters durability of whole spike $(E_2$ and E₄) and florets open at First(E₄). Number of cormels per plant showed moderate to high heritability along with high genetic advance showing additive gene effects. All the genotypic correlation coefficient were higher than phenotypic correlation coefficients. Days to first floret colour showing was positively correlated with days to first floret opening in most of the environments. Days to 50% heading, days to first floret colour showing, days to first floret opening showed significant positive correlation with days to first floret colour showing in most of the environments showed significant positive correlation with corms/plant in most of the environments and rachis length showed significant positive correlation with plant height(cm). Therefore, selection for former characters will be of great significance in a crop like gladiolus, since it increases the aesthetic value of the cultivars. Considering all the floral characters cutivars ArkaAmar, Charm Flow, Green Bay, Poppy Tears, Red Ginger, Punjab Dawn, Darsan, Red Mejestry and Legent were found suitable for commercial cultivation under northern Indian (Prayagraj & Jammu). The promising cultivars for corm and cormels production are Poppy Tears, Candy Man, Hunting Song and Jester.

Key words: GCV, PCV, Heritability, Correlation Coefficient, Stability and Gladiolus.

EXPLORATION OF CONIDIAL FUNGI FROM SOME WATER BODIES OF NAINITAL DISTRICT (KUMAUN HIMALAYA) RUCHI JALAL¹, SARASWATI BISHT¹, SAIMA ALTAF¹, ANJALI TIWARI¹

¹DEPARTMENT OF BOTANY, I.P.G.G.P.G. COLLEGE OF COMMERCE, HALDWANI, NAINITAL

The fresh water ecosystem harbours a variety of micro-organisms, among which aquatic hyphomycetes occupy an important place. These fungi have branched and septate mycelium which colonizes the leaf litter present in running waters and release conidia of magnificent shapes (triradiate, tetraradiate, sigmoid, helical, spiral etc.). Colonization by these fungi renders leaves more palatable and nutritious to invertebrates and play important role in maintaining the energy budget of fresh water ecosystem. These fungi are not only unique in their habitat but also are the bio monitors of aquatic ecosystem as these are almost absent in polluted or stagnant water bodies. Being a significant part of aquatic biology, these fungi are need to be investigated from unexplored water bodies. Kumaun Himalaya, a temperate climatic zone with many water bodies at different altitudes having rich source of substrate pool provides suitable habitat for the growth of diversified forms of aquatic hyphomycetes. Thus, the present investigation aims to find out the diversity of conidial aquatic fungi from different unexplored fresh-water bodies of Kumaun Himalaya along an altitudinal range of 500 m to 1500 m. Decomposed leaf litter was collected periodically from the month of February to September and brought to laboratory for further processing and incubated for sporulation, isolation and identification. Altogether, twelve species of aquatic hyphomycetes were isolated and identified namely, Anguillospora crassa Ingold, Anguillospora longissima Ingold, Alatospora acuminata Ingold, Beltrania sp., Penzig, Clavariopsis aquatica de Wildemann, Cylindrocarpon aquaticum Nilsson, Helicomyces roseus Link, Lunulospora curvula Ingold, Lunulospora cymbiformis Ingold, Setosynema isthmosporum Shaw and Sutton, Tetracladium marchalianum de Wildemann, Triscelophorus sp. Ingold. Among these Tetracladium marchalianum was found to be the most common and tolerant species in all the three seasons winter, summer and rainy. Keywords: Aquatic Hyphomycetes, Diversity, Decomposition, Submerged leaf litter, Pollution indicators.

EFFECTS OF EXPERIMENTAL INFECTION WITH AEROMONAS HYDROPHILA ON DIFFERENT BLOOD PARAMETERS AND HEMATOPOIETIC TISSUE IN SCHIZOTHORAX RICHARDSONII

EFFECT OF WITHANIA SOMNIFERA AND TINOSPORA CORDIFOLIA ON GROWTH AND SURVIVAL OF SNOW TROUT (SCHIZOTHORAX RICHARDSONII)

SHEETAL SHARMA¹, NITYANAND PANDEY², HARISH CHANDRA SINGH BISHT¹ ¹DEPARTMENT OF ZOOLOGY, D. S. B CAMPUS, KUMAUN UNIVERSITY, NAINITAL

²ICAR-DIRECTORATE OF COLDWATER FISHERIES RESEARCH, BHIMTAL, UTTARAKHAND

An experimental study was carried out to investigate the supplementary effects of Ashwagandha (*Withania somnifera*) powder and aqueous extract of Giloy (*Tinospora cordifolia*) on growth and survival rate of Snow trout *Schizothorax richardsonii*. The experiment consisted of four treatments (T1, T2, T3 and T4) in triplicate. The artificial feed was prepared from Rice polish (49%), Oil cake (49%) and vitamin – mineral mixture (2%). The powder of Ashwagandha and aqueous extract of giloy was incorporated into feed at different levels. The treatment T1 (control), was without inclusion of herbal extracts in the feed. In T2, only Ashwagandha powder was mixed in the feed at the rate of 0.5%. T3 was prepared by incorporating 0.5% of aqueous extract of Giloy only and T4 was prepared by incorporating combination of Ashwagandha powder and aqueous extract of Giloy at the rate of 0.5%. 20 fishes of uniform size were stocked in each of $4\times3=12$ tanks. The fishes were fed twice a day at the rate of 3-5% of their body weight. The water quality parameters i.e. water temperature; pH, dissolved oxygen, alkalinity and free CO₂ were regularly monitored during the course of experiment. The survival rate of experimental fish in T1, T2,

T3 and T4 were recorded as 90%, 90%, 95% and 95%, respectively. During the field trial of 90 days, better growth was observed as 9% for T2, 12% for T3 and 15% for T4 in comparison to control, which was significantly (P<0.05) higher than the control group. The study revealed that Ashwagandha (Withania somnifera) powder and aqueous extract of Giloy (Tinospora cordifolia) have positive impact on growth and survival rate of snow trout in captivity. Thus, it is recommended that the blend of Ashwagandha powder and aqueous extract of Giloy may be incorporated in fish feed up to 0.5% for enhancing growth and survival rate of Snow trout. Keywords: Snow Trout, Ashwagandha, Giloy, growth rate, aqueous extract, captivity.

EFFECTS OF EXPERIMENTAL INFECTION WITH AEROMONAS HYDROPHILA ON DIFFERENT BLOOD PARAMETERS AND HEMATOPOIETIC TISSUE IN SCHIZOTHORAX RICHARDSONII

UZMA SIDDIQUI¹, HARISH CHANDRA SINGH BISHT¹ NITYANAND PANDEY².

¹DEPARTMENT, OF ZOOLOGY DSB CAMPUS, KUMAUN UNIVERSITY, NAINITAL 263002, UTTARAKHAND ²DIRECTORATE OF COLDWATER FISHERIES RESEARCH, BHIMTAL-263136, NAINITAL, UTTARAKHAND

The present study was carried out to evaluate the haematological parameters of Schizothorax richardsonii to an experimental infection with. This study was designed to determine the hematological and histological changes in the fish infected with Aeromonas hydrophila+Phosphate Buffer Solution (Bact. +PBS) and PBS compared with control group. The Hematological parameters such as Total Erythrocyte Count (TEC), Total Leukocyte Count (TLC), Hemoglobin (Hb), Hematocrit (Hct), Mean Corpuscular Volume (MCV), Mean Corpuscular Hemoglobin (MCH), Mean Corpuscular Hemoglobin Concentration (MCHC) were compared with the healthy fish. The results clearly indicates that the blood parameters such as Hb, Hct and RBC showed significant difference (p<0.05) and the fish infected with Aeromonas hydrophila +PBS showed highly significant difference in WBC counts then the control group. Significant increased was observed in the values of MCV and MCH in the infected fish. The value of MCHC was at higher side in Aeromonas hydrophila +PBS infected fish with no significant difference. The hematopoietic tissue in spleen and kidney was the most infected organ in the study. The evaluation of blood parameters provide baseline data and as a tool in fish health management.

Keywords- Aeromonas hydrophila, Schizothorax richardsonii, RBC, WBC, Hematological parameters

EFFECT OF DIETARY SUPPLEMENTATION OF GOOSEBERRY/ AMLA (EMBLICA OFFICINALIS) POWDER ON THE PERFORMANCE OF COMMERCIAL BROILER CHICKEN.

KASHMIRI BEGUM¹, JITENDRA KUMAR TALUKDAR² AND NETHEE DEORI³

DEPARTMENT OF POULTRY SCIENCE, COLLEGE OF VETERINARY SCIENCE, ASSAM AGRICULTURAL UNIVERSITY, KHANAPARA, GUWAHATI-781022, ASSAM, INDIA

The present study was undertaken to investigate the effect of dietary supplementation of gooseberry/amla (Emblica officinalis) powder on the performance of commercial broiler chickens. A total of 180 broiler chicks were randomly divided into four groups consisting of 45 numbers, sub divided into 3 replicates consisting of 15 chicks in each sub group. The chicks under T₀, T₁, T₂ and T₃ groups were fed amla powder at the rate of 0.00, 0.25, 0.50 and 0.75% in the feed, respectively. The experiment was conducted for a period of six weeks and followed standard and uniform managemental practice. The per cent livability of all the experimental groups was found to be hundred percent. The total feed consumption per broiler was found to be highest in T_3 group (3694.77g) and the lowest in T_0 group (3679.46g). At 6 weeks of age, the body weight per broiler was highest in T_3 group (2087.56±29.10g) and T_2 group (2074.44±17.00g) gained significantly (P<0.05) higher body weights as compared to T_1 (2070.44±11.88g) and T_0 (2012.13±20.45g). The overall FCR was best in T_3 group (1.76), followed by T_2 (1.77), T_1 (1.78) and T_0 (1.82) groups. The cost of production per broiler was highest in T_3 (INR 201.32) and lowest in T_0 (INR 197.99) groups. Similarly, gross profit was found to be highest in T₃ group (INR 17.18) and lowest in T₀ (INR 13.06) groups. From the results obtained it can be concluded that amla powder can be used effectively and economically as natural feed additive at the rate of 0.75% to improve the overall performance of the broiler chicken.

Keywords: Amla, Broiler, Chicken, performance

IMPACT OF CLIMATE CHANGE AND INDIAN AGRICULTURE: A REVIEW ARTICLE

ANJU YADAV*, SHUBHI PATEL1, ARJUN SINGH RAJPUT* SITHA B.PATEL*

*DEPARTMENT OF AGRICULTURAL ECONOMICS & MANAGEMENT, RAJASTHAN COLLEGE OF AGRICULTURE, MPUAT, UDAIPUR, RAJASTHAN, 313001.

¹DEPARTMENT OF AGRICULTURAL ECONOMICS, BANARAS HINDU UNIVERSITY, VARANASI,221005

Agriculture sector contributes about 17 per cent to the Gross Value Added (GVA) and about 54 per cent of population is dependent on it. Changing climate has direct and indirect impact on agriculture. The increase in temperature is a result of the build up of the GHG (greenhouse gases) emission accumulating in the region. Increasing temperature and decreasing solar radiation levels pose a serious threat in decreasing growth and yield of agriculture crops. The IPCC (Intergovernmental panel on climate change) estimates that the global technical mitigation potential for agriculture (excluding forestry) will be between 5500 and 6000 Mt CO2-equivalent per year by 2030, 89 percent of which are assumed to be from carbon sequestration in soils. Climatic changes in the form of rising temperature and erratic rainfall leads to frequent droughts and floods resulting in variability in agricultural production. Indian agriculture is affected by climatic changes (CC) in terms of erratic rainfall leading to frequent droughts and floods resulting in variability in agricultural production. In higher latitudes, increased temperatures of up to about 1.5 °C may actually provide for increased productivity whereas any increase in temperature lowers productivity in lower latitudes. The total average impact may be positive or negative depending on the climate scenarios (temperature rising in 2°C, 3 °C, 4°C, increase in CO2 and interaction of increase in temperature and CO2). It has a serious threat on food security and environmental sustenance. In order to mitigate the unenviable changes, new technologies, land and water conservation, better crop varieties, livestock management and a check on pollution needs to be initiated.

Keywords: climate change, agriculture, GHG, temperature

EFFECT OF DIFFERENT LEVELS OF POTASSIUM ON NUTRIENT CONTENT AND UPTAKE BY *KHARIF* MAIZE (ZEA MAYS L.)

MOHD. ZAKIR HUSSAIN¹, MRITUNJAY KUMAR¹, RAJEEV SINGH², SWEETI KUMARI¹, DEVENDRA MANDAL² ¹DEPARTMENT OF AGRONOMY, DR. RAJENDRA PRASAD CENTRAL AGRICULTURAL UNIVERSITY, PUSA (SAMASTIPUR) BIHAR – 848 125, INDIA

A field experiment entitled was conducted during *kharif* season of 2017 at Crop Research Farm of Tirhut College of Agriculture, Dholi to see the effect of different levels of potassium on soil properties, nutrient content and uptake by *kharif* maize crop. Experiment was laid out in Randomized block design with four replications and nine treatments at different level of potassium (0, 30, 60, 90, 120 and 150 kg ha⁻¹) in which three treatments T₇, T₈ and T₉ along with 5 tons of FYM. The soil of the experimental field was sandy loam in texture, calcareous in nature with pH 8.2 and low in organic carbon (0.44%). The soil contained 210, 16.32 and 122 kg ha⁻¹ available N, P₂O₅ and K₂O, respectively. N and P content of grain and stover were non-significant due to different treatments. However, significantly higher K content of grain and stover was recorded with treatment T₉ (T₄ + 5 t FYM ha⁻¹). Significantly higher N, P & K uptake of grain and stover were recorded under T₉ (T₄ + 5 t FYM ha⁻¹) as compared to other treatments.

DISTRIBUTION PATTERN AND STATUS OF INSECT PESTS OF TEMPERATE FRUIT ORCHARDS IN KUMAUN HIMALAYA, INDIA

MANOJ KUMAR ARYA AND FASUIL FAROOQ

INSECT BIODIVERSITY LABORATORY, DEPARTMENT OF ZOOLOGY, D.S.B. CAMPUS, KUMAUN UNIVERSITY, NAINITAL- 263002, UTTARAKHAND, INDIA

Kumaun Himalayas harbors a number of temperate fruit trees such as apple, peach, apricot, plum, walnut, pear, kiwi and cherry that increase the economy of the fruit growers of the Uttarakhand state. The present study was conducted in temperate fruit tree orchards located in Nainital and Almora districts of Uttarakhand state during 2016-2018. A total of 1855 individuals of insect pests belonging to 40 species and 38 genera under 16 families, distributed over 3 orders were recorded. Maximum number of insect pests infesting temperate fruit crops were found on apple trees represented by 24 species followed by peach (19 species), apricot (11 species), pear and plum (8 species), walnut (5 species), cherry (3 species), kiwi and citrus with 2 species each. Out of the total 40 species of insect pests, 26 species. The analysis of variance indicated that number of individuals of insect pests of temperate fruit trees during the entire study period was significantly and positively correlated with temperature, relative humidity and rainfall.

Keywords: Insect, Orchard, Pest, species and temperate fruit

DISTRIBUTION AND DIVERSITY OF HYMENOPTERAN INSECTS IN THE DIFFERENT HABITATS OF CORBETT TIGER RESERVE, INDIA

MANOJ KUMAR ARYA AND DAYAKRISHNA

INSECT BIODIVERSITY LABORATORY, DEPARTMENT OF ZOOLOGY

D.S.B. CAMPUS, KUMAUN UNIVERSITY, NAINITAL- 263002, UTTARAKHAND, INDIA

A study on species richness, distribution and diversity of Hymenopteran insects in different habitats of Corbett Tiger Reserve was conducted during 2013-2015. A total of 710 indviduals of Hymenopteran insects belonging to 21 species under 8 families were recorded during the entire study period. On the basis of total number of species Apidae and Scolidae, with 4 species each, were the most dominant families of this order followed Sphegidae and Vespidae (3 species each), Colletidae, Eumenidae and Formicidae (2 species each) and Xylocopidae (1 species).

Keywords: Diversity, Insect, Habitats, Hymenoptera and Species

ROAD SIDE MORTALITY OF INSECT POPULATIONS IN THE LANDSCAPE OF NANDHOUR WILDLIFE SANCTUARY, INDIA

MANOJ KUMAR ARYA AND HEMCHANDRA

INSECT BIODIVERSITY LABORATORY, DEPARTMENT OF ZOOLOGY

D.S.B. CAMPUS, KUMAUN UNIVERSITY, NAINITAL- 263002, UTTARAKHAND, INDIA

A total of 21 species of insects belonging to 3 orders and 6 families were recorded from the road side habitats of the Landscape of Nandhour Wildlife Sanctuary during the study period March, 2019 to August, 2019. On the basis of total number of casualities of insect fauna reported from the study area, order Lepidoptera was the most dominant order followed by Odonata and Orthoptera. The present study reveals that transportation has a negative impact on insect population and led to road mortality of many insects, particularly butterflies. **Keywords**: Butterfly, Diversity, Insect, Mortality and species

PROCESSING OF NETTLE (GIRARDINIA DIVERSIFOLIA) FIBRE FOR PERFORMANCE IMPROVEMENT THROUGH DELIGNIFICATION

BEENU SINGH¹ AND MANISHA GAHLOT²

DEPARTMENT OF CLOTHING AND TEXTILES, COLLEGE OF HOME SCIENCE, G. B. PANT UNIVERSITY OF AGRICULTURE AND TECHNOLOGY PANTNAGAR, U. S. NAGAR, UTTARAKHAND.

In Uttarakhand, nettle grows in wild as undergrowth plant mainly in hilly districts. It is also ecologically gracious plant, having natural resistance to diseases and pests and hence needs no pesticides (unlike cotton). People in different regions of Uttarakhand were traditionally using nettle fiber for making domestic products like ropes, bowstrings and other products. Nettle fiber is very strong, but is also rigid and inextensible because of which it has restricted its usage in handmade textile products only. Therefore, present study was aimed to increase the fiber performance by giving pretreatment through delignification so that this fiber can be used on a range of textile machines for development of a variety of products with enhanced performance. The effect of various experimental parameters, such as chemical concentration and time on nettle fibres has been ascertained by response surface methodology using Box-Behnken design. Total twenty

nine experiments were conducted with four levels in each experiment. The fibers treated for four hours with acetic acid (2%), sodium chlorite (6%) and sodium hydroxide (3%) exhibited the minimum value of lignin (0.72%). The interactive effect of these variables on lignin content of nettle fibers showed that there was an improvement in fiber fineness and strength. The experimental results depicted that there was a significant effect of acetic acid, sodium chlorite, sodium hydroxide and process time on lignin content of fiber. The decreased lignin content of fiber would enable diversification of varied end uses through delignification. **Keywords**: Nettle, Delignification, Performance Improvement, Response Surface Methodology

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ANTIBACTERIAL DYES EXTRACTED FROM MEDICINAL PLANTS *FICUS GLOMERATA* AND *ACALYPHA WILKESIANA*, ITS APPLICATION ON WOOL FABRIC AND TESTING OF ITS FUNCTIONAL PROPERTIES

AADITAA SINGH AND SHAHNAZ JAHAN

DEPARTMENT OF CLOTHING AND TEXTILES, COLLEGE OF HOME SCIENCE, G.B. PANT UNIVERSITY OF AGRICULTURE AND TECHNOLOGY, PANTNAGAR, UTTARAKHAND

Natural dyes are derived from naturally occurring sources such as plants, insects, animals and are nowadays in great demand due to its multifunctional properties as well as eco-friendliness. The dyes extracted from medicinal plants known to possess antimicrobial, UV protective and anti-ageing properties. The most common examples of dyes derived from medicinal plants are turmeric, henna, saffron etc. The study undertaken deals with the extraction of natural dyes from medicinal plants *Ficus glomerata* and *Acalypha wilkesiana*, its application on pure wool fabric and assessment of its functional properties. The extracted dyes were subjected to test against human pathogens i.e. *S.aureus* (gram positive) and *E.coli* (gram negative). The extracted dyes were assessed for the presence of phytochemicals. Application of dye on wool fabric was done using 2% dye concentration at 80°C for 60 minutes. The colour fastness properties as well as functional properties including colour strength, antibacterial activity and ultraviolet protective properties were evaluated. The components presents in raw natural dye and fabric dyed using natural dye were identified on the basis of FTIR analysis. The results obtained showed that both the natural dyes possess good antibacterial activity, ultraviolet protective properties and exhibits good colour fastness properties as well. This study is an innovative approach for identification of new natural dye sources and a potential alternative to provide colour as well as antibacterial finishing to the fabric through sustainable dyeing technique.

Key words: Antibacterial, ultraviolet protection, Ficus glomerata and Acalypha wilkesiana

DYEING OF SILK FABRIC WITH ECOFRIENDLY NATURAL DYE EXTRACTED FROM THE LEAVES OF WILD HIMALAYAN PEAR (*PYRUS PASHIA*)

MANISHA KUMARI¹ AND MANISHA GAHLOT²

DEPARTMENT OF CLOTHING AND TEXTILES, COLLEGE OF HOME SCIENCE, G. B. PANT UNIVERSITY OF AGRICULTURE AND TECHNOLOGY PANTNAGAR, U. S. NAGAR, UTTARAKHAND.

Today, eco-friendly dyes have gained much importance in dyeing of textiles, especially silk fabrics. Many plants have been identified as rich source of dye content and some of them have been used as a natural dye since long. Exploiting natural sources of dyes may create burden on environment. So focus should be on such sources which are not useful or commercially beneficial thus can be used to produce colour on textile substrate without disturbing bio diversity. *Pyrus pashia* also falls in the category of such kind of trees which are not economically beneficial and can be used to produce dye. This plant is abundantly found across the Himalayas. Therefore, present study was aimed to extract dye from the leaves of *Pyrus pashia* and to optimize various dyeing variables. Degumming of silk fabric was done prior to dyeing to make the fabric free from sericin gum. Series of experiments were conducted to determine the dye-extraction pH, optimum concentration of dye, dyeing time and dyeing temperature. The neutral pH exhibited highest colour strength than alkaline and acidic pH. The optimum dyeing conditions for dyeing of silk fabric obtained were 5g dye conc., 80°C dyeing temperature and 60 minutes dyeing time. **Key words:** Pyrus pashia, eco friendly dye, silk dyeing

PRINSEPIA UTILIS ROYLE A PROMISING SHRUB SPECIES FOR LIVELIHOOD GENERATION OF THE LOCAL COMMUNITIES OF UTTARAKHAND HIMALAYAN REGION

KRISHNA KUMAR TAMTA*

DEPARTMENT OF FORESTRY AND ENVIRONMENTAL SCIENCE, D. S. B. CAMPUS, KUMAUN UNIVERSITY, NAINITAL

The Indian Himalaya holds key to India's biological security having some economic aspects and the other enormously vital parameters. Several tree/shrub species of Uttarakhand have the potential to yield edible oil coupled with multipurpose uses. *Prinsepia utilis* Royle is shrub species commonly known as Bikhal and occurs between 1600 and 3000m elevation in the Himalayan region. The seeds of the species are principal sources of edible oil in the remote areas of Himalayan region. The *Prinsepia* seed oil is used for cooking and body massage by the local communities. In the present study we have tried to assess resource potential in a hectare plantation and identify the high oil yielding individuals of the species. Total 92 promising areas of *P. utilis* were identified in Uttarakhand from which 07 potential sites were selected for the study. The density of the species ranged from 540 to 940 indi/ha in the studied location. Total 140 superior individuals of the species were marked in the studied sites and mean kernel oil content percent ranged between $26.03 \pm 2.3\%$ and $39.22 \pm 2.1\%$ (on kernel dry weight basis). The average fruit yield through 1.0 ha plantation ranged from 1.99-3.71 tha⁻¹, seed yield 0.72-1.34 tha⁻¹, kernel yield 0.69-1.30 tha⁻¹ and oil yield 0.29-0.54 tha⁻¹. The average net income through 1.0 ha plantation ranged between Rs. 55,000/- and 1,47,000/-ha⁻¹ year⁻¹. Production of such species on wastelands meets the twin goals of restoration of essential natural assets and can play an important role in providing the opportunities of employment and incomes to the local communities of the region. **Key words:** Shrub, Livelihood, Yield, Kernel and Oil Content.

ORGANIC FARMING FOR SUSTAINABLE AGRICULTURE, ITS PRESENT STATUS AND CHALLENGES

SANJANA SHRIVASTAVA

DEPARTMENT OF EXTENSION EDUCATION, JNKVV, JABALPUR (482002), INDIA

Organic farming is a form of agriculture that relies on ecosystem management and attempts to reduce or eliminate external agriculture inputs, especially synthetic ones. Organic farming is done to prevent the different type of the food residues and different types of the toxic substances, the usages of artificial fertilizers leads to the global warming and also loss to the eco system. Organic farming in sustainable way, means meeting society's food and present needs, without compromising the ability of future generations to meet their needs. India is endowed with various types of naturally available organic form of nutrients in different parts of the country and it will help for organic cultivation of crops sustainability, using organic inputs i.e. compost, blood meals, bone meals, neem cakes, vermi compost, seaweed extracts, vegetable matter (crop residues) etc. About present status worldwide 31 hectares of land in under organic farming it was been managed by 700000 farmers, 138 countries are been growing the organic food and India ranks 33 in the organic farming due to lack of awareness, output marketing problems, shortage of biomass, inadequate supporting infrastructure, high input cost, marketing facilities problems and low yields. For removing all challenges training and knowledge should be provided to the farmer for organic cultivation. Nevertheless, the conclusion is that organic farming prevent residues in the food material, enhance the soil fertility, reduces the erosion which is essential for sustainable agriculture.

Keywords:- Organic Farming, Sustainable Agriculture.

ROLE PLAY OF MEDICINAL PLANTS IN HUMAN HEALTH AND BIODIVERSITY

HARISHCHANDRA DARRO, RAMCHANDRA, RAJESH KUMAR

DEPARTMENT OF AGROFORESTRY, SCHOOL OF FORESTRY & ENVIRONMENT, SAM HIGGINBOTTOM INSTITUTE OF AGRICULTURE, TECHNOLOGY AND SCIENCES, (DEEMED TO BE UNIVERSITY), ALLAHABAD (U.P).

Biodiversity contributes significantly towards human livelihood and development and thus plays a predominant role in the well being of the global population. According to WHO reports, around 80 % of the global population still relies on botanical drugs; today several medicines owe their origin to medicinal plants. Natural substances have long served as sources of therapeutic drugs, where drugs including digitalis (from foxglove), ergotamine (from contaminated rye), quinine (from cinchona), and salicylates (willow bark) can be cited as some classical examples. Drug discovery from natural sources involve a multifaceted approach combining botanical, phytochemical, biological, and molecular techniques. Accordingly, medicinal-plant-based drug discovery still remains an important area, hitherto unexplored, where a systematic search may definitely provide important leads against various pharmacological targets. Ironically, the potential benefits of plantbased medicines have led to unscientific exploitation of the natural resources, a phenomenon that is being observed globally. This decline in biodiversity is largely the result of the rise in the global population, rapid and sometimes unplanned industrialization, indiscriminate deforestation, overexploitation of natural resources, pollution, and finally global climate change. Therefore, it is of utmost importance that plant biodiversity be preserved, to provide future structural diversity and lead compounds for the sustainable development of human civilization at large. This becomes even more important for developing nations, where well-planned bioprospecting coupled with nondestructive commercialization could help in the conservation of biodiversity, ultimately benefiting mankind in the long run. Based on these findings, the present review is an attempt to update our knowledge about the diverse therapeutic application of different plant products against various pharmacological targets including cancer, human brain, cardiovascular function, microbial infection, inflammation, pain, and many more.

Keywords: Medicinal plants, human health and biodiversity.

EFFECT OF VARIABLE STORAGE PERIODS OF MALE ANNIHILATION TECHNIQUE (MAT) LURE ON THEIR ATTRACTANCY TO TEPHRITIDS, FRUIT FLIES, *BACTROCERA* SPP. (TEPHRITIDAE: DIPTERA)

YENDREMBAM K. DEVI12, P. K. MEHTA1 AND M. M. IBRAHIM23

¹DEPARTMENT OF ENTOMOLOGY, LOVELY PROFESSIONAL UNIVERSITY, PHAGWARA-144411

²DEPARTMENT OF ENTOMOLOGY, CSK HIMACHAL PRADESH AGRICULTURAL UNIVERSITY, PALAMPUR-PIN CODE-176062

³UNIVERSITY OF KORDOFAN, FACULTY OF NATURAL RESOURCES & ENVIRONMENTAL STUDIES, DEPARTMENT OF PLANT PROTECTION, EL OBEID P. O. BOX 160 SUDAN.

Fruit flies are considered as menace in tropical and sub tropical areas of fruit and vegetables production. They are the most difficult pests to control as they attain peak activity with the onset of rains; as a result, the residual insecticides applied for their control get washed away. Effective bioagent is less known which can keep the population under control. The repeated application of insecticides may pose serious health hazards to the consumers as well as environment. Sanitation combined with the use of lures and traps as well as baits proved to be the best alternatives for management of fruit flies. These traps have high specificity, low cost and are environmentally quite safe. Male annihilation technique (MAT) is now widely used as an option for area-wide management of fruit flies. MAT utilizes parapheromones viz. methyl eugenol and cuelure, have been found to reduce the fruit flies damage to some extent. One of the major issues concerning the use of male annihilation technique (MAT) is the shelf life of wooden blocks impregnated with lure and toxicant. In order to address this issue, the wooden blocks impregnated with lure and toxicant were stored in simple glass containers and sealed aluminium foil pouches for variable period of time. These were then fitted in bottle traps (Palam Trap) and installed in the field. Palam Trap being used in Himachal Pradesh has been developed by the Department of Entomology, CSKHPKV, Palampur contains spinosad insecticide as toxic component. Some other insecticides were also evaluated for their utization with pheromone lures in MAT. The data on number of fruit flies trapped per week for a period of 7 weeks were taken at cucumber field var., Pusa Sanyog. It can be inferred from the data that irrespective of container, the mean number of fruit flies trapped were significantly more in the lure stored for 10 days (259.25 flies/trap/7 weeks) and was at par those stored for 15 days (184.75 flies/trap/7 weeks) as compared to 30 days (128.75 flies/trap/7 weeks). The mean numbe

at other storage periods were at par. The critical examination of data indicated a consistent trapping between 127.5-142.5 flies/trap/7 weeks at 5, 20, 25 and 30 days storage period. Efficacy on different insecticide revealed that wooden pheromones lures containing spinosad as insecticide resulted in attracting maximum fruit fly population (88.65 flies/trap/weeks) followed by malathion (28.32 flies/trap/weeks) and Lambdacyhalothrin (8.67 flies/trap/weeks).

Keywords: Tephritids fruit fly, Male Annihilation Technique, Spinosad

BIOSORPTION OF LEAD (II) IONS ON LANTANA INDICA LEAVES' BIOSORBENT

ANKITA NEGI*, SUSHIL KUMAR JOSHI, NARENDRA SINGH BHANDARI

DEPARTMENT OF CHEMISTRY, S.S.J. CAMPUS, ALMORA, 263601, UTTARAKHAND, INDIA

In recent years, there has been an increasing ecological and global public health concern associated with environmental contamination by heavy metals. Metal ions are among the most potent pollutants both in groundwater and in surface, as these pollutants damage nerves, liver and bones as well as they block functional groups of vital enzymes due to their extreme toxicity. A study was conducted at S.S.J. Campus Almora, Uttarakhand, India, during October2018-June2019, in which biosorption of Pb(II) ions was carried out on biosorbent (dried and activated biomass of leaves) of *Lantana indica* at different pH (2 to 6) considering pH as one of the state variable. There were batch experiments other than pH as contact time, amount of biosorbent, metal ion concentration and temperature. The optimum pH was found to be 5 for Pb(II) ion adsorption on *Lantana indica* L.f. biosorbent and all other batch experiments were performed at this fixed pH only. Extent of adsorption was found to increase with contact time (25-65 min), amount of biosorbent (1-6gm). The percentage biosorption is found to decrease with increasing metal ion concentration (10-50ppm); however metal uptake is found to increase with increasing metal ion concentration as the extent of adsorption decreases on increasing or decreasing the temperature (25-65^oC) from that optimum value. This extent of adsorption was studied with the help of Atomic Adsorption Spectroscopy (AAS).

Key words: Heavy Metals, Lantana camara, contaminant, biosorption, optimum pH.

PHENOLIC COMPOUNDS AND ANTIOXIDANT ACTIVITY OF MICROWAVE AND STEAM BLANCHED DRIED TURNIP (BRASSICA EAPA L.) LEAVES

^{1,2}SEYEDEH ZEINAB ASADI, ²MOHAMMAD ALI KHAN, ³HOSSEIN BAKHODA

¹YOUNG RESEARCHERS AND ELITE CLUB OF ISLAMIC AZAD UNIVERSITY, SCIENCE AND RESEARCH BRANCH, TEHRAN, IRAN

²DEPARTMENT OF POST-HARVEST ENGINEERING & TECHNOLOGY, AMU, ALIGARH, INDIA

³DEPARTMENT OF AGRICULTURAL MECHANIZATION, SCIENCE AND RESEARCH BRANCH, ISLAMIC AZAD UNIVERSITY, TEHRAN, IRAN

The attempt to exploit vegetables as a valuable source of natural antioxidant and phenolic compounds in the food industry is ubiquitous. These precious substances are most often affected during processing such as blanching and drying. Contrary to phenolic compounds and antioxidant activity of turnip (*Brassica rapa L.*) leaves, they are usually discarded and are not utilised in the food manufacturing sector. The application and management of this vegetable as a valuable ingredient can be challengeable in agriculture and food areas. The current research was undertaken to evaluate the comparison of steam blanching (STB) as a conventional and microwave blanching (MWB) as a non-conventional method on antioxidant activity and total phenolic content of dried turnip leaves. In this perspective, determination of total phenolic content and free radical scavenging activity, DPPH antioxidant capacity, was carried out using the methanolic extraction solution of samples with the help of an ultrasonic bath. The results revealed that dried turnip leaves after either steam blanching or microwave blanching containing a considerable amount of total phenolic content and antioxidant activity, both of which perform an essential role in the quality of food products and also in the health of consumers by retarding or inhibiting the oxidation processes. Besides the present study showed a significant ($p \le 0.05$) reduction of antioxidant capacity in steam blanched dried turnip leaves as compared to that of microwave blanched dried turnip leaves as a comparison with that of microwave blanched dried turnip leaves. It can be deduced that MWB was not only less energy-consuming as compared to STB but also showed better retention of antioxidant capacity in dried turnip leaves. **Keywords**: Microwave blanching, Steam blanching, Turnip leaves, Natural antioxidant, Phenolic compounds

EXPLORING ENDOPHYTES: A SUSTAINABLE APPROACH TO REDUCE OVER EXPLOITATION OF MEDICINAL PLANTS - A PERSPECTIVE

HEMANT SHARMA^A, ARUN KUMAR RAI^{A*}

^A DEPARTMENT OF BOTANY, SIKKIM UNIVERSITY, 6TH MILE TADONG, GANGTOK, SIKKIM, INDIA

Medicinal plants have always remained a primary source for treating common ailments and diseases in some parts of the world lacking basic healthcare facilities. Several allopathic drugs are either transformed or derived directly from plant parts thus putting pressure on already depleting plant resources. Alternative source of some of the metabolites commonly derived from plants would eventually reduce our dependence on plant-based bio-resources. Endophytes are microorganisms residing within plant tissues without causing any adverse effect to the plants for most part of their life cycle and are mostly known for their beneficial role on their host plant. Apart from producing host secondary metabolites outside its host system, some of these microorganisms produce functionalities with potential applications in agriculture, pharmaceuticals and several industrial sectors. Since endophytes have been isolated from all the plants studied so far, there is a strong possibility of obtaining microorganisms producing host secondary metabolites in commercial scale, there are few products derived from endophytes which are being used for growing resilient crops and developing non-toxic feeds for livestock. Our limited understating of the relationship between the endophytes and its host requires better understanding to tap these microorganisms for their unlimited source of important functionalities. Production of host secondary metabolites by endophytes at commercial scale might eliminate our dependence on high valued and vulnerable medicinal plants thus paving a way for sustainable utilization of plant resources. **Keywords**: Endophytes; plant conservation; secondary metabolites

EXISTING PHYSICAL ENVIRONMENTAL CONDITION OF PRIMARY SCHOOLS AND IMPACT ON TEACHER'S SATISFACTION: A STUDY OF RUDRAPRAYAG DISTRICT ANJALI GAIROLA

DEPARTMENT OF FAMILY RESOURCE MANAGEMENT, COLLEGE OF HOME SCIENCE, GBPUAT, PANTNAGAR

In this globalized world, education is known to play a very important role for sustainable development and economic growth of every country. Both the developed and developing countries have invested and increased their national budget for education from year to year. However, some challenging issues for education still exist, and they vary from nation to nation. The challenges relating to physical school environment include classroom facilities, the library, playground, textbook, class size, and, curriculum. On the other hand, challenges relating to emotional environment include bullying, sexual harassment, teacher behavior, school policies, quality of teaching. The strength of an effective school always depends on all aspects of school-level environment (Collie, Shapka, & Perry, 2012). In recent years, four areas of research focused on teachers' perceptions of school environment, teaching efficacy, teacher stress, and job satisfaction have received more attention among researchers and policy makers (Shann, 1998; Tschannen-Moran & Hoy, 2007; Wilson, 2002). The research results have shown that school environment, teaching efficacy, teacher stress, and job satisfaction not only affect teachers in terms of motivation, engagement, and commitment to teaching, but also affect students in terms of learning responsibility and academic performance (Schaufeli & Bakker, 2004; Chen, 2007; Weiss, 1999). A powerful association between aspects of school-level environment and teacher's outcomes such as teaching efficacy, teacher stress, and job satisfaction has been found in recent research studies (Collie *et al.*, 2012; Fisher & Fraser, 1990). In addition, school-level environment has the relationships with professional and organizational commitment (Tarter, Hoy, & Kottkamp, 1990), teacher retention (Miller, Brownell, & Smith, 1999). As all above studies revealed that school environment including physical and other has a significant impact on the satisfaction level of the teacher.

Key word: School environment, teachers and school polices

EFFECTS OF HEAT STRESS ON CELL MEMBRANE STABILITY AND YIELD IN BREAD WHEAT KAVITA

DEPARTMENT OF GENETICS AND PLANT BREEDING, CCS HARYANA AGRICULTURAL UNIVERSITY, HISAR (125004), INDIA

Wheat belongs to the family *Poaceae*, tribe Triticeae and placed in the genus *Triticum*. It is a self pollinated crop. Majority of the world's population use wheat as staple cereal food. Its cultivation area is huge, so it is called as 'King of cereals'. The constantly rising ambient temperature is considered one of the most detrimental stresses, among the ever-changing components of the environment. The global air temperature is predicted to rise by 0.2 °C per decade, which will lead to temperatures 1.8–4.0 °C higher than the current level by 2100. Heat stress substantially affects grain setting, duration and rate, and ultimately reduces its grain yield. Wheat production is estimated to reduce by 6% at each degree rise in temperature. Heat stress also increases hydraulic conductivity of cell membrane as well as plant tissues primarily for increased aquaporin activity and to a greater extent for reduced water viscosity. High temperature can affect or change the biochemical, physiological, and morphological behavior in wheat, which in turn reduces its growth and development. Main physiological traits associated with grain yield under heat stress, such as canopy temperature depression (CTD), cell membrane stability (CMS), and leaf chlorophyll. Heat stress is responsible for ion leakage. Electrolyte leakage is a hallmark of stress response in intact plant cells.

Keywords: Wheat, Heat stress, cell membrane stability

POLYMERS ROLE IN MODERN LIFE SAVITA AGARWAL

DEPT. OF CHEMISTRY, G.D.H.G.COLLEGE, MORADABAD

Polymers are an important part of our life and find their application in thousands of daily and industrial applications. These are large molecules held together by chemically linked subunits called monomers. The first polymer that contained many small repeating units (monomers) was founded by Hermann Stud dinger. The polymers have been around us in the natural world since the very beginning in the form of cellulose, natural rubber, starch, casein, gum and many more while synthetic or man-made polymeric materials are being studied since the middle of nineteenth century. Today, the polymer industry is rapidly growing. Both natural and synthetic polymers are remarkably involved in comfort and facilitation of human life. We use polymers for medication, irrigation, nutrition, clothing, building, communication and for transportation also. Some of the synthetic polymers which we use in our daily life includes nylon in fabrics and textiles, polyvinyl acetate in adhesive and latex paints, teflon in non-stick pan, polyvinyl chloride in pipes. Moreover, the covers and plastic kits comprises of polyethene and tyres of vehicles from Buna rubber. New developed polymers are rapidly entering medical application, such as polyester and polyamides as synthetic suture materials. In this aspect nylon is used as ligament and tendon repair, balloon of catheters. The list is endless. Moreover, polymer innovations have started contributing towards protecting our natural resources as they are widely used to replace many building materials such as-stones, metals, wood, clay, cotton, wool and natural rubber. Therefore, it seems that polymers scare the high quality of life and serve as pacemakers for modern technologies.

Key words-Monomer, Polymer industry, Pacemakers, future materials.

COMPARATIVE PERFORMANCE OF BRINJAL GRAFTS UNDER POLYHOUSE AND OPEN FIELD CONDITIONS <u>NAGMA R. SURVE</u>^{*}, R. G. KHANDEKAR, Y. R. PARULEKAR, P. B. SANAP, M. S. JOSHI AND O. A. NIRMAL DEPARTMENT OF HORTICULTURE, COLLEGE OF HORTICULTURE, DAPOLI, DR. BALASAHEB SAWANT KONKAN KRISHI VIDYAPEETH, DAPOLI

The experiment entitled "Comparative performance of brinjal grafts under polyhouse condition and open field conditions" was carried out in 2018-19 to study the growth and yield performance of brinjal grafts which consists of ten treatment combinations *viz*. T₁:20 days old scion grafted on 20 days old rootstock, T₂:25 days old scion grafted on 20 days old scion grafted on 20 days old scion grafted on 25 days old rootstock, T₅:25 days old scion grafted on 25 days old scion grafted on 30 days old sc

rootstock, T₉:30 days old scion grafted on 30 days old rootstock and T₁₀:Control and each treatment was replicated thrice in Randomized Block Design. The brinjal grafts as per above treatment details were simultaneously planted under open field and polyhouse conditions. The brinjal cultivar 'Swarn Pratibha' was used as rootstock and 'Kali-rawai' was used as scion. Physical parameters of fruits varied nonsignificantly. Under polyhouse conditions the highest yield per plant (0.35kg) was recorded in T₇ and T₈ and lowest yield per plant (0.32kg) was recorded in T₁₀. Highest yield per hectare under polyhouse conditions (6.05t) was recorded in T₇ whereas lowest yield per hectare (5.12t) was recorded in T₁₀. Under open field conditions maximum yield per plant was (1.59kg) recorded in T₄ whereas minimum yield per plant (1.33kg) was recorded in T₁₀. The highest yield per hectare under open field conditions (44.11t) was recorded in T₄ whereas lowest yield (29.62t) was recorded in T₁₀. The results of the present investigation revealed that brinjal grafts planted under open field conditions performed better for growth and yield than under polyhouse.

Keywords: Brinjal, vegetable grafting, polyhouse, open field condition, yield

SEASONAL ABUNDANCE OF ECTO-LARVAL PARASITOIDS, *GONIOZUS NEPHANTIDIS* (MUESEBECK) (HYMENOPTERA: BETHYLIDAE) AND *HABROBRACON HEBETOR* SAY (HYMENOPTERA: BRACONIDAE) ON COCONUT BLACK HEADED CATERPILLAR, *OPISINIA ARENOSELLA* WALKER

¹<u>REPALLE NAGANN*</u> AND SHINDE, C. U. DEPARTMENT OF ENTOMOLOGY, ¹JUNAGADH AGRICULTURAL UNIVERSITY, JUNAGADH, GUJARAT ²NAVSARI AGRICULTURAL UNIVERSITY, NAVSARI, GUJARAT

Survey was conducted in coconut plantations to document the natural occurrence of larval parasitiods of black headed caterpillar under Navsari conditions and results revealed that two larval parasitoids viz., *Goniozus nephantidis* (Muesebeck) (Hymenoptera: Bethylidae) and *Habrobracon hebetor* Say (Hymenoptera: Braconidae) were noticed on *Opisinia arenosella* Walker (Lepidoptera: Crytophasidae). Among them, *G. nephantidis* was the dominant species under Navsari condition of Gujarat state. The maximum parasitism of *O. arenosella* by *G. nephantidis* and *H. hebetor* was observed during 2nd fortnight of May (17.69 and 15.65%) for the both parasitiods, respectively. However, the lowest per cent of parasitism by *G. nephantidis* was found during 1st fortnight of the October (2.23%). Moreover, the per cent parasitism of *H. hebetor* was nil during 1st fortnight of the August to 1st fortnight of the September. The highest numbers of *O. arenosella* larvae were parasitized by G. nephantidis and *H. hebetor* during 2nd fortnight of May (52 and 46 larvae), respectively. The total number of adults of *G. nephantidis* and *H. hebetor* emerged from host larvae were maximum during 2nd fortnight of May (347 and 213 adults), respectively. Moreover, the number of adults of *G. nephantidis* emerged from single larva was noticed during 2nd fortnight of the September (8.80 adults/larva). While, the maximum adults of *H. hebetor* emerged from single larva was noticed during 2nd fortnight of the February (7.57 adults/larva).

Key words: Seasonal abundance, Goniozus nephantidis, Habrobracon hebetor and parasitism etc.

RNA INTERFERENCE (RNAI): A NEW GENE SUPPRESSION TOOL FOR INSECT PEST MANAGEMENT

<u>REPALLE NAGANNA¹</u>, JETHVA, D. M.²AND MAJITHIA, D.J.³

DEPARTMENT OF ENTOMOLOGY, JUNAGADH AGRICULTURAL UNIVERSITY, JUNAGADH, GUJARAT

Insect pests cost billions of dollars in the form of crop and farmers face an ever-present threat of insecticide resistance, therefore, there is a need for identifying some additional effective pest management strategies, which could also augment integrated pest management (IPM). In this scenario, RNA interference (RNAi) offers a great deal of hope in successful mitigation of various insect pests. Gene suppression via RNA interference (RNAi) provides an alternative strategy for insect pest management. RNA interference (RNAi) has been used as a tool for understanding gene function and is being developed as a method to control insect pests. RNAi is a post-transcriptional control mechanism involving degradation of a target mRNA. This degradation is mediated through the production of small interfering RNAs (siRNAs) from the dsRNA, which is cleaved by dsRNA-specific endonucleases referred to as dicers. The siRNAs assembled into an RNA-induced silencing complex (RISC) in conjunction with the Argonaute multi-domain protein, which contains an RNaseH- like domain responsible for target degradation. The process is closely related to post-transcriptional gene regulation by micro RNAs (miRNAs), where the end-result is inhibition of translation initiation.

Keywords: RNA interference, Post-transcriptional gene regulation and insect pests

HYMENOPTERAN PARASITOIDS ASSOCIATED WITH THE *HERCLEUM CANDICANS* LEAF MINER (DIPTERA: AGROMYZIDAE) FROM KUMAUN, UTTARAKHAND

SANGEETA RAWAT, VISHAL KUMAR, PUJA PANT, SANDEEP KUMAR

DEPTT.OF ZOOLOGY, KU SSJ CAMPUS, ALMORA, UTTARAKHAND, INDIA

Leaf mining flies in the family agromyzidae are economically important pest of vegetables and floricultural crops. The larva of the leaf miners feed with in the leaves of the host plant at high densities. This study has been carried out during may 2019 and the specimens were reared from the Hercleum *candicans* leaf miner (Diptera: Agromyzidae). The species of the *Closterocerus trifasciatus* were identified during the study which belongs to the family eulophidae (Hymenoptera: Chalcidoidea). The family Eulophidae includes species which mainly develop as ectoparasites of various insects burrowing or mining plant tissues, including leaf-miners. They play an important role in the biological control of insect pests in the agricultural field and many of them are successfully used in biological control programs all over the world. The successful use of these parasitoids needs a good understanding of their biological characteristics of the agro-ecosystem. Hence, for knowing their role as a biological control agent, the objective of this study was to identified the Agromyzid leafminer, and its hymenopteran parasitoids.

Key words: Agromyzidae, Hercleum candicans, Eulophid, Clostrocerus trifasciatus,

PESTICIDE POLLUTION AND ITS EFFECT ON HUMAN HEALTH & ENVIRONMENT: NEED OF ALTERNATIVE STRATEGIES OF PEST CONTROL IN AGRICULTURE DEVESH KUMAR

DEPARTMENT OF BOTANY, RAJA BALWANT SINGH COLLEGE, AGRA (UP)-282002

Pesticides are usually chemical substances of organic nature, which are either used in agriculture, horticulture or in public health programs to protect the plants and their products from diseases, pests, weeds, rodent and human population from vector insect-borne diseases, like dengue fever and malaria. In general they protects the plants from damaging influences of pathogens, insects and weeds in agriculture. Our present day agriculture has to deal with many important factors, such as food security for increased population, evolution of pesticide resistance in pests, health risks, deterioration of the natural environment, and adverse climatic changes Besides agricultural use pesticides are also in private gardens, along railways, and in other public areas. Examples of pesticides include fungicides, insecticides, herbicides, rodenticides, and synthetic plant growth regulators. Most of the pesticides are associated with negative effect on human health and potentially hazardous effect on environmental. Now-a-days the use of such chemical pesticides is increasing in agriculture for increasing food production to meet the demand of rise in global population. Present work aims at highlighting commonly used pesticides in agriculture and their adverse effects on human health and environment.

Keywords: Pesticides, agriculture, fungicides, insecticides, herbicides, rodenticides.

IMPACT OF INFECTIOUS VIRAL AND PARASITIC DISEASE ON HEALTH SANGEETA- ASSISTANT PROFESSOR

DEPARTMENT OF HOME SCIENCE, RAMABAI GOVT. WOMEN P.G. COLLEGE- AKABARPUR- AMBEDKARNAGAR. (UP) INDIA.

A parasitic disease, also known as parasitosis, is an infectious disease caused or transmitted by a parasite. Many parasites do not cause diseases as it may eventually lead to death of both organism and host. Parasitic diseases can affect practically all living organisms, including plants and mammals. Parasites are living things that used by other living things - like your body - for food and a place to live. You can get them from contaminated food or water, a bug bite, or sexual contact. Some parasitic diseases are easily treated and some are not. Parasites range in size from tiny, organisms called protozoa to worms that cannot be seen with the naked eye. Contaminated water supplies can lead to giardiasis infections. Cats can transmit toxoplasmosis, which is dangerous for pregnant women. Others, like malaria, are common in other parts of the world. If you are traveling, it's important to drink only water you know is safe. Prevention is especially important. There are no vaccines for parasitic diseases. Some medicines are available to treat parasitic infections. Parasites may be present in food or in water and can be identified as causes of foodborne or waterborne illness worldwide. Their lifecycle may also vary. While some parasites use a permanent host, others go through a series of developmental phases using different animal or human hosts. The illnesses they can cause range from mild discomfort to debilitating illness and possibly death. Parasites are organisms that derive nourishment and protection from other living organisms known as hosts. They may be transmitted from animals to humans, from humans to animals. Several parasites have emerged as significant causes of food borne and waterborne illness. **Key words:** Viral and Parasitic disease, Health Hazard and Infectious disease.

KNOWLEDGE LEVEL OF POTATO GROWERS IN NALANDA DISTRICT OF BIHAR

S.L.VERMA/ M.N.ANSARI/ A.K. PASWAN/A.K.SINGH

DEPARTMENT OF EXTENSION EDUCATION, TIRHUT COLLEGE OF AGRICULTURE, DHOLI, MUZAFFARPUR,(RPCAU, PUSA), BIHAR

Potato, the king of vegetables, has emerged as one of the most important food crops of India. Potato ranks fourth after rice, wheat and maize. The power of potato is known for sustaining millions of lives by providing nutritious food in the time of war and hunger. The high production potential per unit area, high nutritional value and great taste make potato one of the most important food crops in our country. The present production of potato could be increased considerably if the available technology is effectively transferred to the farmer. The potato growers need to be properly trained in the latest improved cultivation practices for realizing more productivity and production of crops. Therefore the present study aims to ascertain the knowledge level of potato growers and to explore its relationships with selected socio- economic characteristics of the potato growers. The study was carried out in Nalanda district of Bihar. It was found that maximum number of potato growers had medium level of knowledge towards both the blocks. In case of Biharsarif block, 26.66 per cent of respondents were having low level of knowledge where as 20.00 per cent of selected respondents were possessing high level of knowledge. In case of Katrisarai block, 36.66 per cent of the respondents were shown low level of knowledge while only 13.34 per cent of respondents were fallen under the category of high levels of knowledge. The results of correlation coefficient and multiple regression analysis clearly indicated that the most important factors influencing the knowledge level of potato growers in relation to production technology were cropping intensity, economic motivation and extension contact which were found to be positively and significantly associated with the knowledge level of potato growers. These factors should be kept in mind by policy makers and extension workers while formulating training programme for farming community associated with potato cultivation.

ESSENTIAL OILS: ROLE IN PEST MANAGEMENT

IPSITA SAMAL, TANMAYA KUMAR BHOI, SAMEER RANJAN MISRA DIVISION OF ENTOMOLOGY, ICAR-INDIAN AGRICULTURAL RESEARCH INSTITUTE, NEW DELHI DIVISION OF AGROCHEMICALS, ICAR-INDIAN AGRICULTURAL RESEARCH INSTITUTE, NEW DELHI

Essential oils are volatile natural complex secondary metabolites characterized by a strong odor and have a generally lower density than that of water. There are 17,500 aromatic plant species among higher plants and approximately 3,000 esential oils are known out of which 300 are commercially. They are lipophilic in nature and interfere with basic metabolic, biochemical and physiological and behavioural functions of insects. Genera capable of elaborating the compounds that constitute essential oils are distributed in a limited number of families, such as Myrtaceae, Lauraceae, Rutaceae, Lamiaceae, Asteraceae, Apiaceae, Cupressaceae, Poaceae, Zingiberaceae and

Piperaceae. Important for pharmaceuticals, cosmetics and perfume industries apart from pesticidal potential.Recent research has demonstrated their larvicidal and antifeedant activity, capacity to delay development, adult emergence and fertility, deterrent effects on oviposition, and arrestant and repellent action. Despite these most promising properties, problems related to their volatility, poor water solubility and aptitude for oxidation have to be resolved before they are used as an alternative pest control system. **Key words:** Essential oils, lipophilic, oviposition, arrestant.

IMPACT OF TRAINING ON GAIN IN KNOWLEDGE AND ADOPTION BEHAVIOUR OF KISAN MITRA UNDER RSVY V.K.SINGH¹, A.K. PASWAN ²M.N.ANSARI ³ & SATYAPRAKASH⁴

1 AICRP ON FODDER CROP, RPCAU, PUSA (SAMASTIPUR) BIHAR

2,3&4 DEPARTMENT OF EXTENSION EDUCATION, RPCAU, PUSA (SAMASTIPUR) BIHAR

Rashtriya Sam Vikas Yojana (RSVY) is a special programme launched in the year 2004-05 with the main objective of the scheme are to address the problems of low agricultural productivity, unemployment, and to fill critical gaps in physical and social infrastructure. Training is the vital component for capacity building. Since long time, this has emerged as tool to provide knowledge to participating farmers, farm youths and school drop-outs. Policy initiatives were made to provide training to Kisan Mitra under Rastirya Sam Vikas Yojana (RSVY) with basic idea to equip them with knowledge of crop production technology and, it was expected that the trained Kisan Mitra in turn will provide knowledge to practicing farmers. In order to assess the level of knowledge, attitude and extent of adoption, Kisan Mitra was exposed to pre training and after training on crop production technology. The study was conducted in five blocks of Samastipur district namely Kalyanpur, Pusa, Tajpur, Samastipur and Bibhutipur to know Impact of training under RSVY on adoption behaviour of Kisan Mitra. The findings revealed that Kisan Mitra were found to have good level of knowledge about crop production technology, they did hold positive attitude about the crop production technology and reasonably appreciable level of adoption of these technologies in real field situation. There was high degree of retention of messages in case of production technology related to cereal crops. It appears quite satisfying in the sense that cereals are very important for livelihood security and that is why, Kisan Mitra was found to retain the knowledge. The variable education, family income ,cropping intensity and credit orientation were found to have positive and significant association with the gain in knowledge. The remaining variable did exhibited positive association with the dependent variable.

IDEOTYPE BREEDING AND ITS APPLICATION IN CUCURBITS KHIRUD PANGING¹*, G.C.BORA², LARBEEN TERONPI³

^{1,2}DEPARTMENT OF PLANT BREEDING AND GENETICS, ASSAM AGRICULTURAL UNIVERSITY, JORHAT ³DEPARTMENT OF CROP PHYSIOLOGY, ASSAM AGRICULTURAL UNIVERSITY, JORHAT

Plant breeders have attempted to enhance yield by selecting for individual traits since the beginning of plant breeding. This approach has been broadened to encompass the breeding of model plant or ideotype. An ideotype is a hypothetical plant described in terms of traits that are thought to enhance genetic yield potential. Ideotype breeding is defined as a method of breeding to enhance genetic yield potential based on modifying individual traits where the breeding foal is specified. Ideotype breeding is recommended as a methodology to augment traditional plant breeding, when the breeding goal is enhancing genetic yield potential. Breeding experience and research to date suggest that ideotype breeding is not a suitable substitute for yield breeding. In this method of various morphological and physiological traits are specified and each character or trait contributes towards enhanced yield. Ideotype differs based on crop species, cultivation practices, socio-economic condition of farmers and economic use of plant parts. Ideotype breeding differs from traditional breeding in the sense that values for individual traits are specified in case of Ideotype breeding, whereas such values are not fixed and then efforts are made to achieve such model. In traditional breeding, such models are not developed before initiation of breeding programmes. To further the yield potential of food grain crops, Ideotype have to be evolved for straight varieties and hybrids. Ideotype have to be developed for regard to agrocliamatic conditions. Development of crop Ideotype is a continuous process, Ideotype is a moving goal which changes with advancement in knowledge, new requirements, change in economic policy, etc. Biotechnology may help in the development of insect resistant cultivars through the use of transgenic plants.

Key word: Ideotype, ideotype breeding, morphological, physiological, traits, transgenic plants.

TEMPERATURE VARIATIONS AND TRENDS IN TARAI REGION OF UTTRAKHAND UNDER CHANGING CLIMATE RAVI KIRAN*

DEPARTMENT OF AGROMETEOROLOGY, COLLEGE AGRICULTURE, PANTNAGAR-263145

The present investigation was carried out using the long term (1981-2015) meteorological data recorded at Agrometeorological Observatory situated at NEB CRC, GBPUA&T,Pantnagar, Uttarakhand. The analysis revealed that there is a decreasing trend of maximum temperature over the years. However minimum temperature shows an increasing trend for the data set. Average temperature range shows an increasing trend. The coefficient of variation in case of maximum temperature was found in lowest August (2.4%) and highest in January (9.07%). The coefficient of variation in case of minimum temperature was found in August (1.78%) and highest in June (15.31%), and in case of temperature range it was found lowest in November (8.82%) and highest in January (16.60%). Average maximum Temperature anomaly (^OC) at Pantnagar for 1981-2015 data showed a decrease of 0.007 per year. On the other hand Average minimum Temperature anomaly (^OC) shows an increase of 0.025 per year. Average Temperature Range Anomaly (^OC) showed a decrease of 0.031 per year. The average monthly maximum temperature found to be at peak in the month of May and lowest in July. The lowest average monthly maximum and minimum temperatures were found in January. Average temperature range was highest in April and lowest in August.

Key words: Maximum, Minimum, Range , Temperature, , Trend, Variabilty, Pantnagar, Climate Change, Anomaly .

ROOF / TERRACE GARDENING

¹ALKA SAI, ²RAVINSH KUMAR MAURYA

¹DEPARTMENT OF VEGETABLE SCIENCE, IGKV, RAIPUR, (C.G.)

²DEPARTMENT OF HORTICULTURE, IAS, BHU, VARANASI (U.P.)

Terrace garden or roof garden is any garden on the roof top. Besides decorative purpose, roof plantings may provide fresh horticultural produce, temperature control, hydrological benefits, architectural enhancement, habitats and recreational opportunities. Terrace gardens are

becoming a common feature in today's urban environment. The phenomenon of landscaping on the terraces and rooftops has evolved due to excessive exploitation of the urban land. In such congested environment, rooftops and terraces of buildings remains as a valuable sources for urban horticulture. It is also a potential option for cultivation of some horticultural crops due to its short duration of life cycle and easy to manage on terrace conditions. Besides, terrace cultivation of vegetables, flower and fruits can supply preferential, fresh, toxic free produce with minimum expenditure there by increases monetary value of land per unit area (apartment). In an accessible rooftop garden, space becomes available for localized small-scale urban agriculture, a source of local food production. An urban garden can supplement the diets of the community it feeds with fresh produce and provide a tangible tie to food production. These multi-dimensional uses of terrace gardening encourages urban growers to produce healthy vegetables and fruits round the year. Establishing a roof top garden is eco-friendly and thus can reduce temperatures by 4-5 degree Celsius thus reducing the cooler and air-conditioners utility. Roof gardening industry can be effective in masking the sparsity in vegetable availability in populous nations like India. Besides these benefits, roof garden also helps make the building naturally aesthetic.

Keywords: Rooftops, Landscaping, Aesthetic, Gardening, Recreational.

HOST PREFERENCE OF LAC INSECT, *KERRIA CHINENSIS* IN ASSAM TANJIL RAHMAN¹, PURNIMA DAS²

DEPARTMENT OF ENTOMOLOGY, ASSAM AGRICULTURAL UNIVERSITY, JORHAT, ASSAM

Field and laboratory experiments were conducted at Lac park and Lac Laboratory, Department of Entomology, Assam Agricultural University, Jorhat-13 during May, 2018 to October, 2018 to find out the host preference of lac insect, *Kerria chinensis* (Hemiptera: Kerridae) on two plants *viz*, *Flemingia semialata* and *Cajanus cajan* in respect of their productivity linked parameters and biology. Out of the two plants, *F. semialata* recorded the highest initial density of settlement (105.86±3.37 nos./sq.cm), final density of settlements (94.81± 3.14 nos./sq.cm), cell weight (31.74± 1.82 mg), fecundity (297.77± 6.90 nos. of crawlers /female cell), female longevity (164.52±2.49 days), broodlac yield at harvest (0.30±0.01 kg) and lowest mean percent mortality (13.79± 1.15 /sq.cm). **Keywords**- *Kerria chinensis*, *Flemingia semialata* and *Cajanus cajan*

BIOLOGY OF *CALLOSOBRUCHUS CHINENSIS* ON SEEDS OF *FLEMINGIA* SPP. - A HOST PLANT OF LAC INSECT PREETIPUJA KASHYAP¹, PURNIMA DAS²

DEPARTMENT OF ENTOMOLOGY, ASSAM AGRICULTURAL UNIVERSITY, JORHAT, ASSAM

Laboratory experiment was conducted in the Insect Physiology Laboratory of Department of Entomology, Assam Agricultural University, Jorhat during 2018-19 to study the comparative biology of *Callosobruchus chinenesis* on *Flemingia macrophylla, Flemingia semialata, Vigna radiata* and *Cicer arietinum* seeds. The study revealed that incubation period, larval period, pupal period, total developmental period, adult longevity, fecundity and rate of oviposition varied significantly among different stored seeds. The developmental parameters during the months of June-July and Nov-Dec showed that the total developmental period was highest in *F. semialata* (32.60±0.50 days, 46.4±0.50 days) and lowest in *V. radiata* (25.40±0.24 days, 39.2±0.37 days) in both the seasons respectively. Fecundity was observed to be highest in chickpea (84.2±1.28) and lowest in *F. semialata* (67.6±0.51). Whereas the highest seed infestation percentage recorded in *V. radiata* (76.81±0.88) and lowest in *F. semialata* (65.30±3.21).

Keywords: Host plant, Callosobruchus chinensis, biology

INDIAN DAIRY INDUSTRY

VINOD BHATESHWAR¹, PANKAJ², DWARKI LAL³, AND HANUMAN LAL NEHRA⁴

^{1,2, 3}DEPARTMENT OF ANIMAL HUSBANDRY & DAIRYING, INSTITUTE OF AGRICULTURAL SCIENCES, BANARAS HINDU UNIVERSITY, VARANASI-221005 (U.P.), INDIA.

⁴DEPARTMENT OF LIVESTOCK PRODUCTION & MANAGEMENT, SRI KARAN NARENDRA AGRICULTURE UNIVERSITY, JOBNER, JAIPUR- 303329 (RAJ.), INDIA.

India is the world's largest producer of dairy products by volume, accounting for more than 13% of world's total milk production, and it also has the world's largest dairy herd. As the country consumes almost all of its own milk production, India was neither an active importer nor an exporter of dairy products prior to year 2000. However, since the implementation of Operation Flood Programme, the situation changed significantly and imports of dairy products reduced to very small quantities. From 2001, India has become a net exporter of dairy products and after 2003 India's dairy import has dipped while exports have increased at a fast rate. Yet the country's share in global dairy trade still remains at minor levels of 0.3 and 0.4 percent for exports and imports respectively. This is due to the direct consumption of liquid milk by the producer households as well as the demand for processed dairy products that has increased with the growth of income levels, which have left little dairy surpluses for export. Apart from the rapidly increasing demand for milk and dairy products, other reasons such as the increased cattle feed cost and low availability of dairy farm labour in the rural areas have also resulted in increase in the cost of production. First, cost of production has to be reduced through increasing productivity of animals, improve animal health care and breeding facilities and management of dairy animals. Second, Indian dairy industry needs to further develop proper dairy production, processing and marketing infrastructure, which is capable of meeting international quality requirements. Third, India can focus on buffalo milk based speciality products, such as Mozzarella cheese, in order to meet the needs of the target consumers. **Keywords**: India, Dairy industry, Operation flood, Cattle.

VARIABILITY STUDIES IN BITTER GOURD (MOMORDICA CHARANTIA L.)

TANVI MEHTA¹, D.S. DUHAN² AND RENU YADAV³

DEPARTMENT OF VEGETABLE SCIENCE, CCS HARYANA AGRICULTURAL UNIVERSITY HISAR

The experiment was carried out at Research Farm of the Department of Vegetable Science, CCS Haryana Agricultural University, Hisar during a spring-summer season of 2018. The study material comprised of genetically diverse 27 bitter gourd genotypes from IIVR Varanasi and Department of Vegetable Science, CCSHAU, Hisar which were evaluated in randomized block design with three replications. The genotypes were analyzed on the basis of 16 quantitative characters *viz.*, days to 50% germination, number of primary branches, days to first

male flower opening, days to first female flower opening, nodes to first male flower, nodes to first female flower, leaf length (cm), leaf width (cm), leaf blade, days to first fruit harvest, length of fruit (cm), diameter of fruit (cm), vine length at the time of final harvest (m), weight of 100 seeds (g), number of fruits per vine and fruit yield per vine (kg). Analysis of variance studies exhibited highly significant variation among all the genotypes for all the characters under study except nodes to first male flower, nodes to first female flower, leaf length (cm). So, the results clearly indicate that the selection of genotypes based on the above variable characters can lead to additional improvement in the fruit yield. The variation amid the genotypes with regard to characters might be due to genetic variability, inherent characters and climatic adaptability in a region, which might prove an important diagnostic character for selection of genotypes under local conditions.

Keywords: Variability, quantitative characters, analysis of variance, climatic adaptability

EFFECT OF SCHEDULING OF IRRIGATION AND BIO- EGULATORS ON PRODUCTIVITY OF MUSTARD [BRASSICA JUNCEA (L.) CZERN & COSS]

ASHISH SHIVRAN, RAMESH YADAV AND ASHOK DHILLON

KRISHI VIGYAN KENDRA, MOHINDERGARH, CCS HARYANA AGRICULTURAL UNIVERSITY, HISAR, HARYANA

A field experiment entitled, "Effect of Scheduling of Irrigation and Bio-Regulators on Productivity of Mustard [Brassica juncea (L.) Czern & Coss]" was conducted during the two consecutive rabi seasons of 2012-13 and 2013-14 on loamy sand soil at Agronomy Instructional Farm, Department of Agronomy, C. P. College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar. The objectives were to study the effect of different irrigation schedules and bio-regulators on yield, nutrient concentrations and their uptake and economics of mustard. The experiment comprising sixteen treatment combinations consisting of four irrigation schedules viz., IW:CPE at 0.5 (I₀), 0.7 (I₁), 0.9 (I₂) and four irrigations at bud initiation, branching, pre flowering and pod development stages (I₃), and four bioregulators viz., control (water spray) (C₀), benzyladenine (45 ppm) (C₁), thiourea (1000 ppm) (C₂) and KCl (1000 ppm) (C₃) were tested in a split plot design with four replications. The results of the present investigation indicated that the growth of mustard in terms of Significant increase in yield attributes viz., number of siliquae per plant, number of seeds per siliqua and test weight, as well as seed, stover, biological vields and harvest index of mustard were observed under 0.9 IW:CPE during both the years and on pooled basis over 0.5 IW:CPE and was statistically at par with treatment 0.7 IW:CPE. Different irrigation schedules did not influence the quality parameters viz., oil and protein content of seed during both the years as well as on pooled basis. The economic evaluation revealed that maximum net returns of Rs. 59,666 and 57,153 ha⁻¹ were achieved when irrigation scheduled at 0.9 and 0.7 IW:CPE, respectively. While, maximum B:C ratio (2.99) was recorded under 0.7 IW:CPE during both the years and on pooled basis. Benzyladenine 45 ppm and thiourea 1000 ppm sprays significantly improved the yield attributes viz., number of siliquae per plant, number of seeds per siliqua and test weight as well as seed and stover yields as compared to control and KCl 1000 ppm during both the years. Oil content, oil yield, protein content and protein yield were significantly increased due to benzyladenine 45 ppm and thiourea 1000 ppm over control and KCl 1000 ppm during both the years. The consumptive use of water was increased by all the bio-regulators as compared to control. The highest WUE was obtained with benzyladenine followed by thiourea during 2012-13, 2013-14 and on pooled basis. Foliar application of benzyladenine 45 ppm and thiourea 1000 ppm accrued higher net returns of Rs.53,684 and 47,476 ha⁻¹ with B:C ratio of 2.83 and 2.64 in the years 2012-13 and 2013-14, respectively over rest of the treatments. Thus, from the present study, it seems quite logical to conclude that to achieve higher yield, economic return and water use efficiency in mustard (var.GDM 4), 6 irrigations each of 50 mm depth should be scheduled at 0.7 IW:CPE in addition to two common irrigations and two foliar sprays of benzyladenine 45 ppm at 30 and 60 DAS on loamy sand soil of north Gujarat agro-climatic condition. Key words: Irrigation, Mustard and Bio-Regulators

NON- CHEMICAL APPROACHES FOR MANAGEMENT OF SOIL INSECT PESTS

K.SINDHURA BHAIRAVI¹ AND ARPITA DAS² DEPARTMENT OF ENTOMOLOGY¹, ASSAM AGRICULURAL UNIVERSITY, JORHAT -785013 DEPARTMENT OF ENTOMOLOGY², ASSAM AGRICULURAL UNIVERSITY, JORHAT -785013

Soil insects are notorious pests and are known to cause severe damage and loss of yield amounting to millions all around the world. Management of soil insect pests is of utmost importance but the majority of management practices used or present are chemo centric in nature. Although quite effective, indiscriminate use of pesticides has had a detrimental effect on the soil health and biodiversity including natural pest-predator dynamics. The pesticide residue found in the soil and the produce makes the latter unsuitable for human consumption and is a known cause of many diseases and ailments in humans and livestock. In lieu of the increase in awareness regarding the negative impact of the use pesticides in soil, non-chemical approaches are being sought after and are becoming increasingly popular. These approaches include various agronomic practices, use of natural enemies, entomopathogenic nematodes, acoustic and optical methods. This paper aims to review these safer but equally effective alternatives for the purpose of promoting eco-friendly agriculture options. **Keywords:** Soil insects, natural enemies, EPN, aoustic, optical methods

INTEGRATED NUTRIENT MANAGEMENT IN MUSTARD (*BRASSICA JUNCEA* L.) SURGYAN RUNDLA AND PAWAN KUMAR

DEPARTMENT OF AGRONOMY, CCS HARYANA AGRICULTURAL UNIVERSITY, HISAR-125 004

Mustard accounts for nearly one-third of the oil produced in India, making it the country's key edible oilseed crop. Because of its shorter duration and higher adaptability to different soil types and diverse agro-climatic regions, it has been a promising important oilseed crop. As per data 2017-18 the area, production and productivity of rapeseed-mustard in India is 5.9 mha, 8.4 mt and 1410 kg ha⁻¹, respectively (Ministry of Agriculture & Farmers Welfare, 2018). In 2016-17 Haryana occupies 0.51 million hectare area with 0.81 million tonnes production which account for 8.8 % and 11.9% of the national rapeseed-mustard area and production, respectively and productivity is around 1594 kg ha⁻¹ (Ministry of Agriculture & Farmers Welfare, 2018). Nutrient management is one of the most important agronomic factors that affect the yield of Indian mustard (*Brassica juncia* L). Integrated nutrient management (INM) is the maintenance and a possible increase in soil fertility for sustaining crop productivity through optimization of all the possible sources (organic and inorganic) of plant nutrients required for crop growth and quality in an integrated manner appropriate to the cropping systems and farming situations in its

ecological possibilities (Singh *et al.*, 2014). Green manuring, chemical fertilizers, biofertilizer, compost and FYM *etc.* are major components of INM. Application of Farm yard manure (FYM) improves the soil physico-chemical properties along with direct release of macro as well as micronutrients, ultimately the crop yield increases. It also helps in soil moisture conservation by increasing the water holding capacity of the soil and moderating soil temperature. Application of FYM along with sulphur showed positive effect on crop yield (Rundala *et al.*, 2012). The effect of various doses of organic sources of nutrient along with chemical fertilizer on growth, yield and economics of mustard under terraced situation showed maximum number of branches per plant (10.12), number of siliqua plant⁻¹ (123.11), seed yield (1.44 t ha⁻¹) and stover yield (4.11 t ha⁻¹) were registered with the application of poultry manure 5 t ha⁻¹ (Mukherjee, 2016). Integrated use of 50% recommended dose of nitrogen through chemical fertilizer and rest 50% through FYM resulted an average of 18.4%, 18.5% and 16.5% higher N, P and K uptake, respectively and higher seed oil content over 100% RDF (Mahanta *et al.*, 2019). **Key words:** Nutrient, manure, fertilizer, uptake, siliqua, physico-chemical

STCR BASED FERTILIZER RECOMMENDATION: NEW BOON FOR IMPROVING SOIL FERTILITY

DIKSHA TAJANE^{*1}, RAMETI JANGIR² AND HARIPRASAD PAIKRAO³ *¹DEPARTMENT OF AGRONOMY, NMCA, NAU, GUJARAT- 396450

²CSWRI, ARC, BIKANER- 334006

³DEPARTMENT OF FORENSIC BIOLOGY, GOVERNMENT INSTITUTE OF FORENSIC SCIENCE, NAGPUR

Fertilizer is one of the high cost inputs in agriculture and the use of correct amount of fertilizer is essential for farm profitability and environmental protection. Imbalanced use of fertilizers by farmers not only reduces the yield of the crops but also deteriorates the quality of soil and water resources. To enhance farm profitability under different soil-climate conditions, it is necessary to have information on optimum fertilizer doses for every crop. For determining the optimum fertilizer doses, the most appropriate technique is Soil Test Based Fertilizer Recommendation for different crop which is based on the soil test and crop response studies. Soil test crop response (STCR) concept is more quantitative, precise and meaningful among the various methods of fertilizer recommendation such as general recommended dose (GRD), critical value approach, *etc.* Fertilizer adjustment equation and the ready recknore of optimum fertilizer dose at varying soil test values are valid for various crops grown in different areas of India on the bases of achievements of targeted yield. STCR based fertilizer recommendation is quantitative basis for calculating the profit maximizing dose of fertilizers. Soil Test Based Integrated Fertilizer Recommendation is a viable technology to sustain higher crop productivity and better soil quality under intensive agriculture system.

Key words: FYM, NPK, B:C ratio, yield, Ready recknore equation

ROLE OF FINANCE IN AGRICULTURE DEVELOPMENT

HARENDRA PRATAP SINGH CHOUDHRI, G. P. SINGH, SUPRIYA, PAVAN KUMAR SINGH AND AJEET KUMAR Department of Agricultural Economics, Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya-224229 (U.P.)

Finance is equally important as technology for agricultural development. Sufficient money is must to purchase the technical input. Resource poor farmers suffer from poor financial state and bound to borrow. Till 1935 professional money lenders were the only source of credit who exploits the borrower. With the passing of RBI Act 1934, District central Bank and Land Development Bank come as alternative agency. These banks advanced the short term, medium term and long term loan to the borrower. Although Co-operatives Bank started financing with their establishment in 1930's. The agriculture credit acquired multiagency dimension in bringing "Green Revolution", "White Revolution" and even "Yellow Revolution" finance has played a crucial role. The importance of Agricultural finance in, Agricultural production in this country depends upon millions of small farmers. Institutional funding of the farm sector is mainly done by commercial banks, regional rural banks and cooperative banks. But the institutional sources of credit meet only 51 per cent of the credit requirements of farm sector.RBI set up a one man Committee of Shri R. V. Gupta in December 1997. The Committee submitted its report in April 1998. It was against this background that RBI directed all Public Sector Banks (PSBs), RRBs and cooperative banks to introduce "Kisan Credit Card Scheme (KCCS)" on the lines of the model scheme formulated by NABARD and in due course of time the KCCS was adopted by all the directed agencies. The facts discussed above shows that the role of finance in agriculture and its ancillary sectors in order to adopt the improved scientific technologies for receiving continuous maximum net profit which was the ultimate aim of the agricultural development.

Key words: Agriculture, Farmers, Resources, Finance, Credit Institution

STUDIES ON RAPID MULTIPLICATION METHODS IN BLACK PEPPER (*PIPER NIGRUM* L.) S. P. KADAKE, R. G. KHANDEKAR, M. M. KULKARNI, B. R. SALVI, M. S. JOSHI, O. A. NIRMAL AND NAGMA R. SURVE DEPARTMENT OF HORTICULTURE, COLLEGE OF HORTICULTURE, DAPOLI DEPARTMENT OF MONTY AND AN ANY MONTY AND A DEPENDED AND A DEPENDED.

DR. BALASAHEB SAWANT KONAKAN KRISHI VIDYAPEETH, DAPOLI, DISTRICT- RATNAGIRI (415 712)

The present investigation was carried out at Dr. B. S. Konkan Krishi Vidyapeeth, Dapoli Ratnagiri, Maharashtra, India during the year 2018-19. The experiment was conducted in Randomized Block Design with 5 treatments namely T_1 – Raised bed, T_2 – Soil mound, T_3 – Wooden log, T_4 – Serpentine, T_5 – Bamboo split method which were replicated four times. Total numbers of cuttings harvested per year were significantly maximum in treatment T_4 serpentine method (105.30). Survival of separated saplings was observed significantly maximum in treatment T_4 (serpentine method) 93.58% and 91.83%. The number of leaves, average leaf area, total leaf area, girth of sprout at collar region, sprout length, number of nodes, internodal length, relative growth rate, number of roots, root weight were obtained significantly higher in treatment T_4 (serpentine method). This method was found suitable for rapid multiplication of black pepper than other methods under study Konkan agro climatic conditions.

Keywords: Black pepper, multiplication.

CLIMATE CHANGE IMPACT ON COTTON CROP IN INDIA MANJEET, ANURAG, RAM NIWAS, M.L. KHICHAR, ANIL KUMAR, MAMTA, RAHUL DEPARTMENT OF AGRICULTURAL METEOROLOGY, CCS HAU HISAR

Cotton is a leading cash crop of India. Climate change such as rising temperature, atmospheric carbon dioxide levels, rainfall variability and altering soil physical, chemical and biological properties is observed all around the world. The growth and development depends upon the quantative effect of temperature and other weather parameters. A review over impacts of climate change with relation to crops was done at Department of Agricultural Meteorology, CCS HAU Hisar, to ascertain the future scenario of agriculture branches in view of change climate. In IPCC 2019 special report, increase in temperature 1.5° C from pre-industrial level has been reported. For the last 100 years, the global mean temperature has increased more than 15° C, which is widely not only anthropogenic but also natural phenomenon. Climate change is generally expected to increase crop yields due to CO₂ fertilization, radiation use efficiency and longer growing season but, beyond a critical limit it may develop stress condition like reduce crop duration, change pest populations, hasten mineralization in soils and increase evapotranspiration etc. that can decrease crop production. So it can be held that, climate change would have intensive impacts on cereal and horticulture crops health and productions as well as soil properties.

Keyword: Climate change, Elevation CO2, Shifting Season, Infestation

EFFECT OF PACLOBUTRAZOL ON PLANT GROWTH, AND FRUITING QUALITY OF LITCHI (*LITCHI CHINENSIS* SONN.) CV. ROSE SCENTED

RAJANI PANT¹ AND D.C. DIMRI²

DEPARTMENT OF HORTICULTURE, G.B. PANT UNIVERSITY OF AGRICULTURE AND TECHNOLOGY, PANTNAGAR (U.S. NAGAR) UTTARAKHAND.

Litchi is the most important sub-tropical evergreen fruit. It is botanically designated as *Litchi chinensis* Sonn. and commonly known as litchi or lychee. Paclobutrazol (PP 333) is commonly known as "Cultar" and used as a way of improving crop productivity and dwarfing a wide range of fruit crops. It is a cell elongation and internode extension inhibitor that retards plant growth by inhibition of gibberellins biosynthesis. The effect of paclobutrazol at varying time intervals of litchi as soil drench application (1.0, 2.0, 3.0 and 4.0 g a.i. per meter canopy diameter) on Growth and Fruiting qulity of Litchi (*Litchi chinensis* Sonn.) was investigated during 2016-18 in Pantnagar condition. The vegetative growth was significantly reduced due to higher dose of paclobutrazol (2.0-3.0 g a.i./meter canopy diameter). Application of paclobutrazol at the rate 2.0, 3.0 a.i./tree through soil application method was noted to be more efficient in increasing total number of flowers, fruit set, fruit length, width, fruit weight, volume and yield. On the basis of overall effect of paclobutrazol at different dates of application, it can be concluded that the application of paclobutrazol @ 40 ml/tree (2.0 g a.i. per meter canopy diameter) in the month of October proved to be more effective for reducing vegetative growth and increasing flowering, fruit set and yield, fruit length, width, weight and volume as well as fruit chemical attributes viz; TSS, ascorbic acid, sugars and anthocyanin content (appearance) while, it reduces titratable acidity. **Key words:** Paclobutrazol, Litchi, Growth.

STUDIOUS ON NPK FERTIGATION IN BROCCOLI (BRASSICA OLERACEA VAR. ITALICA) UNDER TARAI REGION OF UTTARAKHAND

SAJAL DEBBARMA*, LALIT BHATT AND AND LAVLESH

DEPARTMENT OF VEGETABLE SCIENCE, G.B. PANT UNIVERSITY OF AGRICULTURE AND TECHNOLOGY, PANTNAGAR, UTTARAKHAND

Broccoli is a cool season vegetable crop of Brassicaceae family. It is a very delicious, nutritious and exotic vegetable grown. Broccoli is the upcoming cash crop of the country. It contains multiple nutrients with anti-cancer properties such as di-indolylmethane and sulphoraphane. Water and fertilizer are the two major inputs for broccoli cultivation and they are interrelated in their effects on plant growth, yield and quality of broccoli. Since, water and fertilizer are costly inputs, every effort must be taken to enhance the water and fertilizer use efficiency by reducing their wastage. Since broccoli is a new emerging vegetable crop in our country, there is limited information on application of water soluble fertilizer through drip fertigation, which have become recently available in the market. The present investigation was undertaken to standardize the NPK fertigation in broccoli at Vegetable Research Centre of G.B. Pant University of Agriculture and Technology, Pantnagar (Uttarakhand) for two consecutive years i.e. 2016-17 and 2017-18. The experiment was laid out in two factorial randomized block design with one additional treatment consisting of five fertigation levels viz_{i} , F_{1} :120 percent of RDF, F_{2} : 100 per cent of RDF, F₃: 80 per cent of RDF, F₄: 60 per cent of RDF and F₅: 40 per cent of RDF and three fertigation scheduling viz., S₁: 25, 15 and 20 per cent N, P2O5 and K2O of fertigation levels between 5-20 days after transplanting (DAT), respectively, 40, 15 and 25 per cent N, P2O5 and K₂O of fertigation levels between 21-36 DAT, respectively, 20, 50 and 40 per cent N, P₂O₅ and K₂O of fertigation levels between 37-52 DAT, respectively, 15, 20 and 15 per cent N, P_2O_5 and K_2O of fertigation levels between 53-68 DAT, respectively, S_2 : 25 per cent of each N, P2O5 and K2O between 5-20 DAT, 21-36 DAT, 37-52 DAT and 53-68 DAT, respectively and S3: 20, 20 and 20 per cent N, P2O5 and K₂O of fertigation levels between 5-20 DAT, respectively, 40, 30 and 20 per cent N, P₂O₅ and K₂O of fertigation levels between 21-36 DAT, respectively, 30, 30 and 30 per cent per cent N, P₂O₅ and K₂O of fertigation levels between 37-52 DAT, respectively and 10, 20 and 30 per cent N, P2O5 and K2O of fertigation levels between 53-68 DAT, respectively, along with one control (soil application of RDF with flooding) replicated thrice. Results indicted that fertigation at 100 percent RDF (F2) through scheduling S1 recorded significantly higher yield (15.43 t/ ha and 15.09 t/ ha), net return (Rs 160061.4 and 155002.19) and benefit cost ratio (3.24 and 3.17) and was best treatment combination.

RARE, ENDANGERED, THREATENED PLANT SPECIES OF KUMAUN HIMALAYA, UTTARAKHAND, INDIA FALAK SIDDIQUI¹, L.S. LODHIYAL¹ AND NEELU LODHIYAL²

¹DEPARTMENT OF FORESTRY AND ENVIRONMENTAL SCIENCE, D.S.B. CAMPUS, KUMAUN UNIVERSITY, NAINITAL

²DEPARTMENT OF BOTANY, D.S.B. CAMPUS, KUMAUN UNIVERSITY, NAINITAL

Uttarakhand Himalayan region is very rich in biodiversity as there are large varieties of flora and fauna due to its diverse geographic setup. Among the plant species, about 701 plant species are used in different forms of medicine as well as in livelihood needs of the residents. But

recently, many plant species of Himalayan region are disappearing from its native sites, therefore some of the plant species have become rare, endangered, threatened, extinct and vulnerable due to their over exploitation, infrastructure developments by human beings. Beside this, variation in the climate has also impacting them. Consequently, they are known as rare, endangered, and threatened as per the IUCN Red list category. These plant species are relatively less studied in reference to the resource base, location of potential sites and propagation techniques, seed germination, viability, storage and maturation time. In the absence of baseline data of such species the future management strategies for their sustenance would be difficult. Keeping in view, we have to decide that how such types of species could be conserve and manage in the Himalayan region. Therefore an experiment has been made by the department at the Himalayan Botanical Garden, Nainital. In this paper, four plant species as Berberis asiatica, Rauvolfia serpentina, Diploknema butyracea and Gingko biloba was used for their propagation and regeneration based on various methods. The planting materials i.e. stem, root and seed were used for propagation and their multiplication. Present study findings may be one of the important strategies for future conservation and management in the Himalayan region.

Keywords: Biodiversity, Conservation, IUCN, Kumaun Himalaya, Propagation

RAINFALL TREND DURING MONSOON PERIOD IN DISTRICTS AMBALA AND SIRSA, HARYANA

RAHUL^{*1}, AMIT SINGH¹, MANJEET¹ AND SUSHIL² ¹DEPARTMENT OF AGRICULTURAL METEOROLOGY, CCS HAU HISAR ²DEPARTMENT OF SOIL SCIENCE, CCS HAU HISAR

This study was conducted at Department of Agricultural Meteorology, CCS HAU Hisar, rainfall variability of Ambala and Sirsa district of the Haryana over the period of 31 years (1987-2017) during monsoon season was studied. District Ambala lies on the North-Eastern edge of Haryana between 27.75° North latitude and 74.88° to 76.86° East longitude while Sirsa is located at 29.53° North latitude to 75.02° East longitude. The information about rainfall variability and its trends is an important input for the policy makers for agricultural planning, water resource assessment, hazard mapping, flood frequency analysis etc. During Monsoon season rainfall varied from 393 mm to 1334 mm in Ambala district and in Sirsa district received rainfall between 65 mm to 490 mm. The statistical analysis showed a decreasing trend of rainfall over the period during monsoon season from 1987 to 2017. The most prominent decrease in the rainfall during the study was observed in Ambala district as compared to Sirsa district during monsoon season.

Keyword: Rainfall variability, Monsoon

IMPACT OF SIMULATED ACID RAIN ON BRASSICA OLERACEA VAR. BOTRYTIS SUMAIRA JAMEEL KHAN

DEPARTMENT OF BOTANY, MOHAMMAD ALI JAUHAR UNIVERSITY, RAMPUR (UP).

Acid precipitation is known to affect almost all the living and non living things. In the present study, impact of simulated acid rain was observed on Brassica oleracea var. botrytis. Four pH levels (6.0, 5.0, 4.0 and 3.0) were developed by adding sulphuric acid (1N H2SO4) to distilled water. The seedlings were showered at the rate of 4mm rain from each type of pH levels and distilled water as control separately in exposure chamber and the effects were noted at regulated time intervals. Symptoms, plants growth, yield and leaf pigments were recorded after harvest. Chlorosis, necrotic spots on lamina and marginal necrosis were observed at quite early stages. All the levels of simulated acid rain adversely affected the plant growth, yield and the photosynthetic pigments as compared to the control. As the level of acid rain increased, the reduction in the parameters was also increased with the highest reduction being observed at pH 3.0 levels. Thus it was concluded that all the reductions in the concerned parameters were concentration dependent.

Keywords: Brassica oleracea var. botrytis, photosynthetic pigments, necrotic spots.

ASSESSMENT OF APHID INFESTATION LEVELS ON TWO CULTIVARS OF BRASSICA JUNCEA WITH VARYING **DEFENSIVE TRAITS**

FARHA REHMAN¹ AND FAREED A. KHAN²

DEPARTMENT OF BOTANY MOHAMMAD ALI JAUHAR UNIVERSITY RAMPUR U.P. 244901

ENVIRONMENTAL BOTANY RESEARCH LABORATORY, DEPARTMENT OF BOTANY, ALIGARH MUSLIM UNIVERSITY, ALIGARH -202002, INDIA

In the present study two cultivars were selected to investigate the effect of aphid herbivory on two cultivars of mustard (Rohini and Alankar). Each of the selected variety (Alankar and Rohini) was independently infested with 0 (control), 50, 100 or 150 aphids per plant at 45 DAS. The comparative response of growth, physiological, biochemical and other parameters were recorded and analyzed at 60 and 75 DAS, whereas yield was recorded finally at harvest (120 DAS). Highest Reduction was recorded at 60 and 75 DAS growth parameters (length of shoot, root, total plant, leaf number and area and plant fresh and dry mass), aphids also induced adverse changes in the stomata and their dynamics (relative stomatal closure index, frequency of stomata) and hence affected the stomatal gaseous exchange, net photosynthetic rate, level of photosynthetic pigments (chlorophyll a, b, total chlorophyll and carotenoids), protein content and nutritional quality (NPK level) of the two selected cultivars. The increase of proline content reflected the protective response of cultivars against aphid induced water stress in plants. The decline in all these parameters contributed to decreased yield attributes (pod length, pods per plant, seeds per pod, 1000 seed weight and seed yield) including seed oil content. This decrease was more pronounced in cv. Rohini as compared to cv. Alankar. Higher level of proline in Alankar suggested better protective mechanism in this cultivar as compared to Rohini. From the present study it was concluded that Rohini was aphid susceptible cultivar and and Alankar was aphid resistant cultivar. Key words- Aphid infestation, Lipaphis erysimi, Photosynthetic pigments

BIOCONTROL OF HELICOVERPA ARMIGERA *IRAM KHAN TAHIR & AZRA SHAHEEN MOHAMMAD ALI JAUHAR UNIVERSITY RAMPUR (U.P.) INDIA

The objective of this work is to improve the EPN formulation process based on the scientific and technological research developed so far. Entomopathogenic nematode formulation technology has made significant progress in past 15 years. The results show great progress in the EPN survival time, the mortality of insect pest, decrease in pod damage and the increase in crop yield. Also, EPNs formulated and applied

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as insect cadavers showed higher efficacy for the pest control than the EPNs applied in an aqueous solution. Major challenges have included the development of room-temperature shelf stability, ease of use, and contamination control. **Key words:** Adjuvants, *Vigna mungo*, formulation, *Oscheius nadarajni*.

EFFECT OF SODIUM SULPHATE ON GERMINATION GROWTH AND YIELD PARAMETERS OF *PISUM SATIVUM* (VAR . P. ARKIL)

GULAFSHAN

MOHAMMAD ALI JAUHAR UNIVERSITY, RAMPUR (U.P.)

Salinity is one of the most brutal environmental factors limiting the productivity of crop plants because most of the crop plants are sensitive to salinity caused by high concentration of salts in the soil, and the area of land affected by it is increasing day by day. The objective of this study was therefore to investigate the effect of salinity on germination and growth of *Pisum sativum* (var . p. Arkil). All growth attributes such as germination, shoot and root length decrease with salinity levels increased (0.4%,8%,12% and 16%). Salt (Na₂ So₄) stress through enhancement of osmotic pressure leads to the reduction of germination, growth and effect the yield of the plant. Saline soil induces physiological and metabolic disturbances in plants effecting development, growth and yield. Salt stress decreases the photosynthesis and respiration rate of plants but increase the level of proline.

Keywords: Salinity, Pisum sativum, Proline, Na2 So4 effect.

IMPACT OF KRISHI VIGYAN KENDRA TRAINING ON TECHNOLOGY ADOPTION, YIELD AND ECONOMICS OF WHEAT PRODUCTION UNDER UTERA SYSTEM

K.K. DESHMUKH, G. K. RANA, N.K. SINGH AND K.P.S. SAINI J. N. K. V. V. KRISHI VIGYAN KENDRA, SEONI-480 661 (M.P.)

The Krishi Vigyan Kendra have to play four important functions Viz, on farm trails, demonstrations, trainings to farmers and farm women and training to extension persons. Out of these functions farmers training plays important role to dissemination of scientific technologies between the targeted groups. The results of the training conducted by various KVK's and other training programme show that the trained farmers produce higher yield at the groups than the untrained farmers. A farmers training was organized by KVK in village Tikari, Block Barghat, Seoni on scientific method of cultivation of the utera wheat. An innovative and progressive ten farmers a native of village Tikari were have been adopted the improved packages of practices/Technology and gain higher production of utera wheat. Before adoption of improved technology average yield was 11.0 q/ha. After adoption of scientific technology they were got average yield 37.0 q/ha., net profit of Rs. 45597/- per ha. with an expenditure of Rs. 18595/- Per ha. and higher B:C ratio 3.45. While before adoption of technology they have getting net profit Rs. 9085/- with expenditure Rs. 12590 and B: C ratio1.5. Technology have been adopted by more than 60 farmers in surrounding of adjoining villages and sown about an area of 220 ha. and getting more net profit. **Key word:** - Utera, Improve package, Training

APPLICATION OF BA ON TAGETUS ERECTA (L.) CV. PUSA NARANGI GAINDA

MANAS MANDAL¹, SOUMEN MAITRA², ANAMAY SARKAR³, BELLAPAKONDA GOUTHAM KISHORE⁴, DEBASIS MAHATA⁵, BAPPA PARAMANIK⁶

1,2,3,4 DEPARTMENT OF FLORICULTURE, MEDICINAL AND AROMATIC PLANTS, FACULTY OF HORTICULTURE, UTTAR BANGAKRISHIVISWAVIDYALAYA, PUNDIBARI, COOCH BEHAR, WEST BENGAL.

5. AGRONOMY, UTTAR DINAJPUR, KVK, CHOPRA, WEST BENGAL, INDIA.

6. SOIL SCIENCE, DAKSHINDINAJPUR, KVK, MAJHIAN, PATIRAM, WEST BENGAL, INDIA.

The research was studied at the instructional farm of the Department of Floriculture, Medicinal and Aromatic Plants, Faculty of Horticulture, Uttar Banga Krishi Viswavidyalaya, Pundibari, Cooch Behar, West Bengal to study the effect of benzyl adenine (BA) on the production of African marigold cv. Pusa Narangi Gainda from November 2016 to March 2017. Twelve different levels of BA were applied to the African marigold. The different dose was T1- 25 ppm, T2- 50 ppm, T3-75 ppm, T4-100 ppm, T5-125 ppm, T6-150 ppm, T7-175 ppm, T8-200 ppm, T9-225 ppm, T10-250 ppm, T11-275 ppm and T12-300 ppm along with T13= control. Several effects were found among them vital two parameters mentioned here are the weight of ten flowers and Diameter of flowers. The maximum weight of flowers was found highest in T7 treatment (87.42 gm), followed by T6 (75.34 gm) and T4 (71.32 gm) treatment compared with control. Another parameter, Diameter of flowers was found the maximum diameter in T7 (7.25 cm) followed by T5 (7.08) and T6 (7.07 cm) treatment compared with control.

Key word:- BA, Tagetus erecta, Flower diameter, Flower weight

INNOVATIVE APPROACH IN SOIL HEALTH, LAND RESOURCES AND LAND USE PLANNING AND MANAGEMENT ANIK CHAKRABARTY, SHAIBAL CHAKRABORTY AND DEBORSHEE LAHIRI

Soil health is presented as an integrative property that reflects the capacity of soil to respond to agricultural intervention, so that it continues to support both the agricultural production and the provision of other ecosystem services. The major challenge within sustainable soil management is to conserve ecosystem service delivery while optimizing agricultural yields. It is proposed that soil health is dependent on the maintenance of four major functions: carbon transformations; nutrient cycles; soil structure maintenance; and the regulation of pests and diseases. Each of these functions is manifested as an aggregate of a variety of biological processes provided by a diversity of interacting soil organisms under the influence of the biotic soil environment. Analysis of current models of the soil community under the impact of agricultural interventions (particularly those entailing substitution of biological processes with fossil fuel-derived energy or inputs) confirms the highly integrative pattern of interactions within each of these functions and leads to the conclusion that measurement of individual groups of organisms, processes or soil properties does not suffice to indicate the state of the soil health. A further conclusion is that quantifying the flow of energy and carbon between functions is an essential but non-trivial task for the assessment and management of soil health. Humans depend on both natural and managed (including agricultural) ecosystems for a range of what have been called 'environmental (or ecosystem) goods and services. These processes are aggregated into four ecosystem functions, which we propose collectively provide the basis for all the major services provided by soil. Transformation of carbon through the decomposition of plant

residues and other organic matter, including soil organic matter, together with the synthetic activities of the soil biota, including, and particularly, soil organic matter synthesis. Decomposition in itself is not only an essential ecosystem function and driver of nutrient cycles but also supports a detoxification and waste disposal service. Cycling of nutrients, for example nitrogen, phosphorus and sulphur, including regulation of nitrous oxide emissions. Maintenance of the structure and fabric of the soil by aggregation and particle transport, and formation of biostructures and pore networks across many spatial scales. Biological regulation of soil populations including organisms recognized as pests and diseases of agriculturally important plants and animals as well as humans. The soil system is an open one and its health is affected by external environmental and anthropogenic pressures. The reaction of the soil system to these pressures can be described in terms of resistance and resilience. Resistance is denoted by the magnitude of the change in state for a given level of perturbation. It further indicates a change in conversion ratio, for example a reduction in the respiration rate arising from compaction. Resilience describes the capacity of the system to return to its original state following perturbation and reflects the 'self-healing' capacity of the soil system, a concept that maps onto that of self-organization. Indeed, resilience may be a way of measuring the capacity for selforganization in soils. Some formally demonstrated examples of soil resilience are where the soil structure rejuvenates following compaction, microbial biomass reverts to antecedent concentrations following a drying cycle or decomposition potential is restored following a temperature perturbation. If the perturbation is within the capacity, the soil system can recover to its original condition, but if not, a permanent loss of soil health is expected. For example, in the latter study, while the grassland soil under study was resilient to a heat perturbation, this was not the case where the soils were subjected to copper

Keywords: soil health, agricultural impact, ecosystem services, biological processes and functions, indicators

ORGANICALLY RESIDUE FREE FARMING

MADHVENDRA BAHADUR SINGH*, SAMPURNANAND SINGH AND GAUTAM PRATAP SINGH DEPARTMENT OF HORTICULTURE (POMOLOGY), BIHAR AGRICULTURAL UNIVERSITY, SABOUR, BHAGALPUR, BIHAR-813210

Residue free farming can be phrased as the use of organically derived biocides and bio fertilizers to protect the crops and augment their growth. In today's era where technology plays a pivotal role in each and every sector, it's important to understand the use of technology in the field of agriculture. By adopting modern day agri-technologies like greenhouses, drip irrigation system, fertigation, if integrated fertilizers management, ipm- integrated pest management, residue free production, rain water harvesting, high density plantation, contour farming, waste land utilization, etc., it becomes relatively easy to maintain the quality of the produce and also add to the nutritional value to the same. The process of growing the produce starts from crop selection-land preparation- seed selection - seed sowing- irrigation- crop growth-harvesting- grading - packaging - transportation- Retail Outlets/Customers. An important element to note in the process is the lack of use of chemical fertilizers and use of natural fertilizers like cow dung and earthworm manure. This one change itself accounts for a big difference in the residue content of the product and takes it a notch further in making it residue free. Due to rapid evolution and increased awareness in the health segment, people are now focused on the benefits of consumption of fresh and residue free food. In order to support this change, it is necessary to adopt the practice of residue free farming where in the food that is produced is pure, fresh, healthy and nutritious. This produce is grown in an eco-friendly way and without the use of any hazardous chemical fertilizers in order to benefit the end consumer in the best possible way.

Keywords- Organically, Residue, fertigration, ipm

VEGETABLE GRAFTING - A NOVEL TECHNIQUE FOR MITIGATING THE STRESS: REVIEW GARIMA DIWAN, DHANANJAY SHARMA

DEPARTMENT OF VEGETABLE SCIENCE, COLLEGE OF AGRICULTURE, IGKVV, RAIPUR (C.G.)

Vegetables are the best resource for overcoming micronutrient deficiencies and provide smallholder farmers with much higher income and more jobs per hectare than staple crops. Environmental stress and biotic stresses severely influenced the cause of crop losses worldwide, reducing significant losses in average yield of vegetable crops every year. Grafting is an eco-friendly approach which is used to control soil borne diseases and abiotic stress viz. flooding, drought, salts, low and high temperatures, grafts were generally used and increasing the yield of susceptible cultivars for sustainable vegetable production. Many countries have reported substantial losses of yield due to soilborne diseases, which could be controlled by grafting to disease resistant rootstocks. Growth, yield and quality of fruit vegetable are affected by grafting. The rootstock is the portion of the plant that controls the uptake, synthesis and translocation of water and minerals from the soil and the scion must be able to transport and use what the rootstock delivers. The perfect combination of these parts results in a successful plant potential benefits that can respond to both abiotic and biotic stress in a given environment without decreasing yield or fruit quality. Ultimately it reduces the uses of agrochemicals. In India some seed industries and agricultural institutes are evaluating grafting as a viable option for preventing the biotic and abiotic stress for cucurbits and solanaceous (fruit vegetables). Grafting also avoids loss of time and loss of important traits by introducing resistance genes into modern cultivars. This practice is rare in our country and there have been few experiments to determine optimal grafting production practices for different geographical and climatic regions in India. In India about 50 % land is facing various problems like degradations of soil and water, lowering down of water table, salinity, alkalinity, macro and micronutrient deficiency, leaching of salts and various pollutants contamination. Hence, given the diversity of potential uses, there is a need to design knowledge-based strategies for specification of breeding rootstocks with the scion and increase grafting success using different technique of grafting to prevent this type of problems.

Key words: Grafting, root stock, scion, stress management, growth and quality.

TO DEVELOP MULTIDENTATE LIGANDS EMPLOYED IN VARIOUS SINGLE-SITE CATALYST KINETICALLY PERSISTANT

SHWETA TYAGIA AND KAPIL TYAGIA

DEPTT. OF CHEMISTRY, GREATER NOIDA INSTITUTE OF TECHNOLOGY, GREATER NOIDA

Multidentate ligand are capable of donating two or more pairs of electrons in a complexation reaction to form coordinate bonds. The development of multidentate ligands to explore the coordination chemistry of metal ions in solution and in the solid state and also to control their reactivities in catalysis is one of the most compelling and challenging activities in chemical research. The two major problems

encountered with highly active single-site catalysts of the form LMOR are (i) the Schlenk equilibrium that leads to the formation of inactive L2M and [M(OR)2]n aggregates and (ii) catalyst deactivation due to presence of adventitious water and metal oxide formation. The development of synthetic pathways and catalyst/initiator systems to produce pre-designed polylactides, as well as the fundamental understanding of the polymerization reactions, has continuously been an important topic. The metal catalyzed ring-opening polymerization (ROP) of cyclic esters is an efficient way to produce the biodegradable polymers from cyclic esters. The purpose of the research was to develop a trispyrazolylborate ligand that would make the catalyst kinetically persistent means changing relatively slowly.

PROSPECTS OF USING BIOACTIVE COMPONENTS FROM THE FRUIT WASTE IN THE CHOCOLATE DEVELOPMENT JASPREET KAUR*, JASLEEN KAUR, AKASHDEEP SHARMA, DR NASEER AHMAD DEPARTMENT OF FOOD SCIENCE AND TECHNOLOGY, RIMT UNIVERSITY

Fruit waste Chocolate was prepared by incorporating dried citrus limetta peel and pisdium guava leave, which were dried using tray (50°C, 70°C), hot air oven (50°C, 70°C) and under sun drying conditions. It is rich in vitamin C, phenols, flavonoids and antioxidants. Nutritional and sensory qualities of the fruit waste chocolate incorporated with various levels of peel and leave were carry out. This study was carried out to develop a chocolate utilizing the waste products of juice industry viz. mosambi peel and guava leave. The vitamin C and phenol content analysis in chocolate showed a decreasing trend, which were observe on storage at, refrigerated temperature. On sensory evaluation by using 9-point hedonic scale (TD:50:S1, TD:70:S1, OD: 50:S1, OD: 70:S1 and SD:S1) was found to be the best among the various dried sample. The nutritional quality of (TD:50:S1, TD:70:S1, OD:50:S1, OD:70:S1 and SD:S1) was analyzed for 45 days period and it was found that moisture was found to decrease with increase in storage period. Moisture content, ash content, protein, antioxidant content, reducing sugar, total reducing sugar, ascorbic acid, total phenolic content (TPC), PH, total plate count, yeast and mold count were analyzed. Storage study were conducted for 45 days on packed optimized chocolate using aluminium foil & stored at refrigerator temperatures.

RECENT TRENDS IN RICE BRAN OIL EXTRACTION AND PROCESSING KAPIL TYAGIA AND SHWETA TYAGIA

GREATER NOIDA INSTITUTE OF TECHNOLOGY, GREATER NOIDA

Rice bran oil (RBO) is popular in several countries such as Japan, India, Korea, China and Indonesia as cooking oil. <u>Rice bran</u> is a <u>by-product</u> of rice milling industry and constitutes around 10% of the total weight of rough rice. Rice bran oil was obtained from rice bran by solvent extraction using ethanol and other several techniques used for the extraction of the RBO, but solvent extraction using hexane is the most popular used conventional method for commercial extraction. The use of hexane in the conventional methods has some drawbacks due to its flammability, toxicity and high temperature involved in the process resulting in some undesirable components in the oil as a result of oxidative deterioration, developments of rancid and off-flavor. Efforts were made by many researchers to explore different other nonconventional techniques for the oil extraction which contains the micronutrients like vitamin E complexes, gamma oryzanol. In recent years, research interest has been growing in RBO processing to obtain good quality oil with low refining loss. This review article deals with detailed reports on RBO extraction and processing.

INSECTICIDAL EFFICACY OF KOLMOU (*IPOMEA CARNEA* L) AGAINST BRUCHID (*CALLOSOBRUCHUS CHINENSIS*) GAURAV KASHYAP¹, PRIYANKA BORBARUAH¹, INEE GOGOI¹, DEBANAND DAS² ¹DEPARTMENT OF ENTOMOLOGY, ASSAM AGRICULTURAL UNIVERSITY, JORHAT-13, INDIA ²DEPARTMENT OF NEMATOLOGY, ASSAM AGRICULTURAL UNIVERSITY, JORHAT-13, INDIA

Aqueous extract of Kolmou (*Ipomea carnea* L.) was evaluated in the laboratory, Department of Entomology, Assam Agricultural University, Jorhat, to determine its effect on adult mortality of Bruchid (*Callosobruchus chinensis*). Residue film technique was carried out with different concentrations *viz*.7.00, 5.00, 3.00, 2.00, 1.00 and 0.50 percent. Among all the concentrations highest mortality was found at 7.00% with 100% mortaliy after 72 hours. The LC₅₀ value was found to be 0.45% after 72 hours of treatment. Thus, the *Ipomea carnea* extract has insecticidal potential against the target insect which can be the alternative for synthetic insecticides. **Key words:** Kolmou, *Callosobruchus chinensis*, LC₅₀, Aqueous extract

SCOPE FOR ADOPTION OF PRECISION AGRICULTURE TECHNOLOGIES IN DEVELOPING COUNTRIES IRSHAD HUSSAIN

DEPARTMENT OF EXTENSION EDUCATION, AAU, JORHAT

Precision farming is an approach where inputs are utilised in precise amounts to get increased average yields, compared to traditional cultivation techniques. It precisely establishes various operations, such as the best tillage, application of fertilizer, sowing, irrigation, harvesting etc and turns traditional extensive production to intensive production according to space variable data. In India, one major problem is the small field size. More than 58 per cent of operational holdings in the country have size less than one hectare. PA can be classified into two categories: namely, 'soft' and 'hard'. It can be commented that balanced use of soft and hard PA will be the deciding factor for its success in India. But fragmented lands are the main obstacle for large scale agricultural mechanization. But these fragmented lands are cultivated in a family responsibility system, and all small farmers have been following consciously or unconsciously 'soft' PA technology for centuries. 'Soft' PA depends mainly on visual observation of crop and soil and management decision based on experience and <u>intuition</u>, rather than on statistical and scientific analysis. Three components, namely, 'single PA technology', 'PA technology package' (for the user to select one or combination) and 'integrated PA technology', have been identified as a part of adoption strategies of PA in the developing countries. The chlorophyll meter (SPAD) and leaf color chart (LCC) are simple, portable diagnostic tools that can be used for in situ measurement of the crop N status in rice fields to determine the timing of N top dressing, which is very useful for developing countries and GIS is currently being adapted for use on small Asian farms, in Japan, the Republic of Korea and in the Taiwan Province of China.

Keywords - Precision Agriculture, Developing Countries, Adoption

INSECTICIDAL EFFICACY OF ROUGH COCKLEBUR (XANTHIUM STRUMARIUM L) AGAINST BANANA LEAF AND FRUIT SCARING BEETLE (NODOSTOMA SUBCOSTATUM JACOBY)

PRIYANKA BORBARUAH¹, GAURAV KASHYAP¹, INEE GOGOI¹, DEBANAND DAS² ¹DEPARTMENT OF ENTOMOLOGY, ASSAM AGRICULTURAL UNIVERSITY, JORHAT-13, INDIA ²DEPARTMENT OF NEMATOLOGY, ASSAM AGRICULTURAL UNIVERSITY, JORHAT-13, INDIA

Chloroform extract of rough cocklebur (*Xanthium strumarium* L) was evaluated in the laboratory, Department of Entomology, Assam Agricultural University, Jorhat, to determine its effect on adult mortality of banana leaf and fruit scaring beetle (*Nodostoma subcostatum* Jacoby). Residue film technique was carried out with different concentrations *viz*.7.00, 5.00, 3.00, 2.00, 1.00 and 0.50 percent. Among all the concentrations highest mortality was found at 7.00% with 100% mortaliy after 72 hours. The LC₅₀ value was found to be 1.12% after 72 hours of treatment. Thus, the *Xanthium strumarium* extract has insecticidal potential against the target insect which can be the alternative for synthetic insecticides.

Key words: Rough cocklebur, Nodostoma subcostatum, LC₅₀, Chloroform extract

DOUBLING FARMER'S INCOME: NOVEL STRATEGIES AND NEEDED CHANGES

DIPANKAR SAIKIA¹ AND SUBHRA SAHOO² ¹DEPARTMENT OF EXTENSION EDUCATION, RPCAU, PUSA, SAMASTIPUR ²DEPARTMENT OF AGRONOMY, RPCAU, PUSA, SAMASTIPUR

Government of India set a policy target of doubling farmer's income by 2022. Doubling farmer's income in such a short period is not an easy task. It might require novel strategies and some changes in the policy stance, so there is an urgent need of transformation in agricultural production combined with integrated farming system (IFS) which include crop cultivation, dairy, poultry, fishery, mushroom cultivation, piggery, bee keeping, forestry, vegetables and fruit production, biogas etc. When we talk about diversification in farm, it mostly deals with high value crops. Access to economic and sustainable production could be ensured by adoption of Farming system approach, focuses should also be on conservation agricultural technology, more investment in agricultural research and development, adoption of good agricultural practice, implementation of farmers friendly policies, judicious and sustainable use of available resources and inputs along with establishment of good market structure and transportation facility, minimum support price (MSP) reform, supported by adequate and on time availability of bank credits. Literature reveals that between 2004-05 and 2011-12 the real per caput farm income (from agriculture and activities) of farmers increased by 64%. Data of NSSO and CSO of 2012-13 revealed only a 34% increase in farmers real per caput income. It has been reported that a rise in MSP will raise the farmer's income by 13-26 %. Smart farming and credit supportive smart farming are other possible strategies in doubling farmer's income.

Key words: Doubling farmer's income, Farming system, MSP

EFFICACY OF ENDOPHYTIC BACTERIA AGAINST FUSARIUM WILT OF CUCUMBER (CUCUMIS SATIVUS) PRANAB MALAKAR

SCHOOL OF CROP PROTECTION, COLLEGE OF POST-GRADUATE STUDIES IN AGRICULTURAL SCIENCES, CENTRAL AGRICULTURAL UNIVERSITY (IMPHAL), UMIAM, MEGHALAYA- 793103, MEGHALAYA, INDIA

Fusarium wilt caused by *Fusarium oxysporum* f. sp. *cucumerinum* is an important soil borne disease of cucumber (*Cucumis sativus*) that causes remarkable yield losses in the susceptible varieties. This disease is favoured by warm soil temperatures and low moisture content. Wilting of the lower leaves occurs at warm temperatures and the leaves recover under cooler temperatures. The fungus basically survives as chlamydospores in the soil and in plant debris. The use of fungicides causes environmental pollution. Keeping in mind, the present investigation has been formulated to evaluate the potential bacterial endophytic antagonists against Fusarium wilt of cucumber. Nine isolates of *Fusarium oxysporum* f. sp. *cucumerinum* were characterized morphologically on PDA. The virulent strains obtained from pathogenicity were used for the study. The healthy plant tissues were used for the isolation of native endophytes from the cucumber plant. The endophytes were identified as *Pseudomonas fluorescens*, *Bacillus* sp. and *Seratia* sp. (42.92 %). There was significant difference in inhibition comparing *Seratia* sp with *Bacillus* sp. and *Pseudomonas fluorescens*. The comparible strains of the bacterial endophytes were applied in the field for disease suppression. Disease suppression was 42.22 ± 2.94 % when compared with the positive control and 23.3 ± 1.67 % when compared with the negative control. Thus, these isolates can be further evaluated under different field conditions.

ENDOPHYTES: A PRUDENT OPTION FOR DISEASE AND PEST MANAGEMENT

KAKUMONI SAIKIA*, HRISHIKESH HAZARIKA AND L.C. BORA

DEPT. OF PLANT PATHOLOGY, ASSAM AGRICULTURAL UNIVERSITY, JORHAT, ASSAM

Plant pathogens have remained an important constraint to crop production and productivity, worldwide. In chemo centric approach, a variety of chemicals are used for management of plant diseases but excessive use of those chemicals imposes a serious threat to the environment. Microbial antagonists such as endophytes, have come up as alternative methods that has the potential of reducing the use of chemical compounds in agriculture. Endophytes are the microorganisms that survive inside healthy plant tissues without causing any detrimental effect to the plant and are associated with the host by symbiotic, mutualistic or commensalistic relationship. They act as reservoirs of novel bioactive secondary metabolites, such as alkaloids, phenolic acids, quinones, steroids, saponins, tannins and terpenoids that have potential antimicrobial, anti-insecticidal and many more beneficial properties. Entomopathogenic endophytes play vital role in reducing pest load by the virtue of antibiosis or feeding deterrence. Endophytes, hence is an important and interesting complex occupying a unique niche worth for exploration.

Keywords: Endophytes, Antagonists, Secondary metabolites

IMPACT OF NITROGEN MANAGEMENT ON THE PERFORMANCE OF BLACK RICE (ORYZA SATIVA L.) UNDER MID HILL CONDITIONS OF MEGHALAYA

PHURAILATPAM MENAKA SHARMA*¹, LALA I.P. RAY²

$^{1}\mathrm{COLLEGE}$ of agriculture, central agricultural university, imphal, manipur

²COLLEGE OF POSTGRADUATE STUDIES, BARAPANI, MEGHALAYA

The Small Grain aromatic rice (Oryza sativa L.) has a special place in the Eastern and North-Eastern parts of India for its immense flavour and palatability. However, the main constrain with majority of the farmers is its low yielding nature. So, with the objective to address some of the drawbacks an experiment was designed to assess the performance of this rice under four different nitrogen sources and three planting geometry under mid hills of Meghalaya during kharif season of 2016-17. An agronomical trial was laid out with four different sources of nitrogen fertilization viz. 100% Inorganic (F1), 100% Organic (F2), 50% Organic +50% Inorganic (F3) and Control (F0) and replicated thrice. Organic source of nitrogen was Farm yard manure (FYM) and inorganic source were urea and di-ammonium phosphate (DAP). Various growth parameters like plant height (cm), number of tillers per hill, leaf area index (LAI); yield parameters like number of panicles per hill, test weight, grain yield (t ha-1); quality attributes like percentage protein, iron and zinc content in grains; and Benefit Cost Ratio (BCR) were taken into account. The best performer was observed under 50% organic + 50% inorganic sources among all the treatments in terms of growth, yield and quality parameters. Benefit cost ratio (BCR) was maximum with 2.12 (F3) and superior over F0, F1 and F2. The

highest grain yield was recorded from F3 with 1.29 t ha⁻¹ over the other remaining treatments. **Key words:** Aromatic, North East India, Low yield, Nitrogen sources, Agronomical

IMPROVEMENT OF ENDANGERED MEDICINAL PLANT- REVIEW

I. GOPINATH¹ AND B K NAMRIBOI²

¹DIVISION OF GENETICS, IARI, NEW DELHI

²DEPARTMENT OF PLANT PATHOLOGY, GBPUAT, PANTNAGAR

India is a biodiverse nation having rich varieties of flora owing to the geo-ecological diversity found withing its boundaries. The landscapes are hub to many plants species rich in medicinal compounds. Many of these medicinal plants are yet to be explored and identified. Some of these have reached endangered and vulnerable levels in ecosystem while some have already been extinct, reasons being several as changing climate, increasing pollution, human intervention and deforestation. *Valeria* sp. is a perennial flowering herb favoured for its root and rhizome. The extracts are most commonly associated with treatment of insomnia, verified for hypnotic effects and anxiolytic activity. Other medicinal plants such as climbing legume *Mucuna pruriens* is the best known natural source of L-dopa, the gold standard for treatment of Parkinsonism. In wild it is found growing on tree trunk and is very itchy to touch due to serotonin and mucunain present in the fine dense hairs lining the seed pods. This even makes breeding procedures such as crossing and handling for phenotypic examination a difficult task. *Paris polyphylla*, a vulnerable plant containing potent medicinal values is used for its root as being antipyretic, detoxicant, antiasthmatic, antitussive and sedative. Similarly poplar is a very important forest species with some being endangered (*Populus nigra*; black poplar) whose wood is used most commonly for several purposes. It is medicinally used to loosen chest congestion and as a stimulant while some people directly apply the extract to skin sores, bruises, cuts, and external haemorrhoids. Species as such are currently gaining importance in genetic improvement programs aiming development of domestication characters *vis a vis* wild traits with efficient end usage. Such domesticated species as in mucuna and *Paris polyphylla* could be very accepted for garden cultivation and aesthetics. Therefore, these species contain huge potential for medicinal improvement and need further studies to be conducted.

Keywords: Medicinal plants, extracts, improvement, domestication.

BREEDING FOR GRAIN QUALITY IN RICE- REVIEW.

I. GOPINATH¹ AND KAMRE KRANTHI KUMAR¹

¹DIVISION OF GENETICS, IARI, NEW DELHI

Rice is an important staple food eaten routinely by more than half of the world's population and is found in a wide variety of cuisines. Consumer preference of rice depends on the cultural tradition of each region of the world and it is associated with quality aspects of the grains. Good quality rice can both fetch huge economic returns to the farmer and increase the consumption maintaining the variety as important market player. Therefore, breeding for consumer preferred improved cooking and eating quality of rice has become crucial for most breeding programs around the world. As a complex trait grain quality is determined by several physical and chemical properties. In breeding programs, the major grain quality considerations evaluated are milling efficiency, grain shape and appearance, cooking and edibility characteristics for palatability and nutritional quality. Several grain quality traits decide the consumer preference for rice such as grain length to breadth ratio, chalkiness of endosperm, gelatinization temperature, amylose content, gel consistency, aroma, grain colour and grain shape. The preference for rice differs from consumer to consumer. Traits like amylose content and grain shape are the major determinants of rice profits apart from high yield. Health conscious consumers prefer high protein in aleurone layer with enriched micronutrients such as iron and zinc known as biofortified rice. A high yielding variety may not be good quality rice in all the quality aspects thus affecting it economy as was the case with PAU 201. Several of the breeding programs and studies were conducted to improve the lines grain quality and dissect the genetic basis. QTLs identified for physical traits and for cooking determining traits such as qSAC3, qAC1, qGC7 etc. and many such could be used in breeding programs to improve the genotypes. Entries and genotypes are tested for all the quality traits in breeding programs before concluding any future use of a genotype which is also strictly followed in AICRIP trials in India. Therefore it is mandatory and ineludible to check the breeding material for grain quality ensuring long term market prevalence of variety if released.

Keywords: Rice, grain quality, breeding, consumer.

PHYTOPHTHORA INFESTANS: RE-EMERGENCE AND ITS CAUSES HRISHIKESH HAZARIKA* AND KAKUMANI SAIKIA

DEPARTMENT OF PLANT PATHOLOGY, ASSAM AGRICULTURAL UNIVERSITY, JORHAT,

Worldwide, the diseases caused by plant pathogens result in major economic losses. Among plant pathogens, *Phythophthora infestans* has emerged a major threat to global food security. The pathogen derives its generic name from the Latin language, which literally translates into "The Plant Destroyer". The pathogen finds its place in world history as the reason behind the infamous Irish famine (1845-1852) that brought widespread devastation to the potato crop in Ireland, where it was staple. Even now, the pathogen emerges again and again in epidemic form and cause seasonal loss, mainly to the tomato and potato industry. Several reasons can be attributed to the re-emergences of the pathogen. Climate, diverse sources of inoculum, migration, pathogen's ability to overcome control measures are some of them. Another reason attributed is the Psychological impact on the world left behind by its wrath in the great Irish famine, which leads to its comparison with the "Black Death". The fast evolving nature of the pathogen makes it hard to control as new strains of the pathogen emerge every now and then, owing to plastic nature of its genome. It is very fast adapting and unfortunately, the rate of its evolution exceeds far more than the rate at which new strategies of control are coming up. New diagnostic tools and efficient forecasting systems could be answer to the threat raised by the pathogen. But, without active surveillance and real time models to study the changes in pathogen's behaviour, it will not be possible to actively predict its incidence and aggressiveness. Pre-existing models of forecasting late blight will have to adapt to the pathogen's interaction with environmental and climatic factors.

Keywords: Phytophthora infestans, Re-emergence, Irish Famine

AGRO-BASED INDUSTRIES AS AN INNOVATIVE APPROACH IN AGRICULTURAL SCIENCES AND ITS IMPACT ON INDIAN ECONOMY

ABHIJIT DAS¹, DIPANKAR SAIKIA²

¹DIVISION OF DAIRY ECONOMICS, STATISTICS & MANAGEMENT, NATIONAL DAIRY RESEARCH INSTITUTE, KARNAL, HARYANA

²DEPARTMENT OF EXTENSION EDUCATION, DR. RAJENDRA PRASAD CENTRAL AGRICULTURAL UNIVERSITY, PUSA, BIHAR

Industrial development not only depends on innovation and capital outflow in a country, but also it needs availability of raw materials and adequate physical infrastructural facilities. Agriculture is one of the major raw material providing sector for major industries like paper, sugar, textile, fertilizers, chemical, edible oil, etc., Agro processing sector has experienced expansion during last 5 decades, starting with a handful of facilities which were mainly operating at domestic/cottage level.Agro-based industries can play an important role to a large extent in solving the problem of poverty, unemployment and inequality in India and can significantly contribute to the overall development of the economy by efficiently utilizing the local raw materials which consequently may result in increase of gainful employment opportunities to poor people mainly landless, marginal and small farmers. The study provides a summary of the growth history of the sector covering role of R&D, recent trends vis-a-vis crop-wise status of agro processing industrialization and problems, export trends, SWOT analysis and thrust areas for future for achieving greater role of this sector in the national economy. **Key words:** Agro processing sector, National economy

A REMEDY FOR WATER CRISIS- INNOVATIVE JALKHUND AND MICROIRRIGATION MUTATION: A TOOL FOR CROP IMPROVEMENT AND NUTRITION SECURITY

JOME RIME¹, MEGHA RAGHAVAN¹, VIVEK ANUMALA², S ROMEN SINGH¹

¹DEPARTMENT OF FRUIT SCIENCE, COLLEGE OF HORTICULTURE AND FORESTRY, CENTRAL AGRICULTURAL UNIVERSITY, PASIGHAT, ARUNACHAL PRADESH

²DEPARTMENT OF VEGETABLE SCIENCE, COLLEGE OF HORTICULTURE AND FORESTRY, CENTRAL AGRICULTURAL UNIVERSITY, PASIGHAT, ARUNACHAL PRADESH

Most efficient tool available to plant breeders in their quest to develop improved cultivars and a scientific cause of crop evolution is mutation. A mutation is a change in the structure as well as function of a gene. In most cases, it is deleterious as it means that the gene doesn't produce what it should. However, mutations can result in valuable new traits. Spontaneous mutations occur in nature at a relatively continuous and frequent rate. In almost all the crops species, large numbers of spontaneous mutations have been recorded and used either directly as new cultivars or breeding line in breeding programs. In all vegetatively propagated crops, mutations are being used successfully for developing new cultivars (e.g. changes in fruit color or time of fruit maturity, etc). Recent decades have witnessed intensive work on the induction of mutations by using irradiation, chemicals and other mutagenic agents. The frequency of induced mutations almost doubles those occurring naturally and they have been looked on as a powerful tool for the development of new cultivars. However, available mutagens cause not only changes in genes but also chromosomal aberrations, many of which are deleterious in their effect on the trait and on the entire organism. Consequently, there have been a limited number of induced mutations directly usable as new cultivars. Since mutation particularly spontaneous mutation is an ultimate source of variation and speciation in entire living organisms that ultimately resulted in natural evolution of cultivated species from their wild sources. In the mid of 19th Century induced mutation became a most effective tool for crop improvement and in the beginning of 21st century mutations has became an efficient tool in the reverse genetics. **Keywords:** crops, cultivars, mutagens, spontaneous, etc.

FATE OF GENETICALLY MODIFIED CROPS IN INDIA-REVIEW BK NAMRIBOI¹, IKKURTI GOPINATH² AND SNEHA SHIKHA¹ ¹DEPARTMENT OF PLANT PATHOLOGY, GBPUAT, PANTNAGAR ²DIVISION OF GENETICS, IARI, NEW DELHI

Biotechnology is one of the most reviewed and extensively researched agricultural developments in human history. One such developments using biotechnology, however, has given multiple promises, concerns and question, namely Genetically Modified Organisms (GMOs). The acceptance of GMOs generated intense public debates in many parts of the world and in India also this has engaged the attention of government and farming societies. Foods produced from or using GM organisms are often referred to as GM foods. The initial objective

for developing GM crops was to induce crop protection and herbicide tolerance. There are several regulations governing GM crops that differ between countries to assess and manage the risks and benefits of GM crops. The choice of GM crops varies from country to country with insect resistant cotton in African countries and India to herbicide resistant soybean in USA. The definition of GM crops and organisms provided by the apex organization of the country regulating the genetically modified organisms decides the fate of such improved species. The GM crops used as food are of major concern to consumers in terms of public acceptance. Risk regulation is concerned with the governance of risks to health and safety weighed against social and economic interests. There have been numerous reports of "unintended effects" in the genetically engineered crops. Over the past decade biotechnology has been very successful in helping farmers producing higher yield. The acceptance of the GM crops among farmers is still a challenge regarding few notable failures in India. Therefore, it is important to regulate GM crops in every aspect.

Keywords: Genetically Modified Organisms, biotechnology, acceptance, risk, farmers.

PCR-BASED TECHNIQUES FOR PLANT PATHOGEN DETECTION-REVIEW BK NAMRIBOI¹, IKKURTI GOPINATH² AND SNEHA SHIKHA¹ ¹DEPARTMENT OF PLANT PATHOLOGY, GBPUAT, PANTNAGAR ²DIVISION OF GENETICS, IARI, NEW DELHI

Food losses due to crop infections from pathogens such as bacteria, viruses and fungi are persistent issues in agriculture for centuries across the globe. In order to minimize the disease induced damage in crops during growth, harvest and postharvest processing, as well as to maximize productivity and ensure agricultural sustainability, advanced disease detection and prevention in crops are crucial. Based on the fidelity of DNA hybridization and replication, Polymerase Chain Reaction (PCR) is one such direct and advanced pathogen detection method invented by Kary Mullis in 1987. PCR is an *in vitro* method of exponential amplification of a target DNA/RNA strand. PCR provides various advantages over conventional methods of detection: PCR possesses exquisite sensitivity, with the theoretical potential to detect a single target molecule in a complex mixture without using radioactive probes; and it is proficient and quick. Amplified products are separated by agarose gel electrophoresis and specific bands obtained are used to detect the pathogen and study the polymorphisms. Many derivative methods in PCR for pathogen detection such as real time PCR, multiplex PCR, RT-PCR, nested PCR, Bio-PCR, etc, facilitates the detection of a single pathogen or many members of a group of related pathogens, however, it requires designing specific primers to amplify DNA for detecting different pathogens. The cost prohibitive procedure thus limits its application only to laboratory settings and high value target analytes. Intuitively, PCR based plant pathogen detection is a versatile method and has a great practical importance.

Keywords: PCR, detection, in vitro, pathogens

BANANA PEEL A POTENTIAL FISH FEED

GERIK BAGRA¹, GURPREET KAUR CHAGGAR², RAHUL SEN³, RIKKI BAGRA⁴

¹DEPARTMENT OF HORTICULTURE, ASSAM AGRICULTURAL UNIVERSITY, JORHAT, ASSAM-785013.

² FOOD SCIENCE, PURDUE UNIVERSITY, WEST LAFAYETTE, IN 47907, UNITED STATE.

³DEPARTMENT OF AGRIC.CHEMISTRY & BIOCHEMISTRY, ASSAM AGRICULTURAL UNIVERSITY, JORHAT, ASSAM-785013.

⁴DEPARTMENT OF AQUACULTURE, COLLEGE OF FISHERIES SCIENCES, ASSAM AGRICULTURAL UNIVERSITY, RAHA, NAGAON, ASSAM-782103.

India tops the list of producer of Banana (Musa spp.) among all other nations. In terms of monetary gains, it is the fourth most internationally traded food crop besides rice, wheat and corn. It is a rich source of dietary fiber, proteins, essential amino acids, vitamins and minerals like magnesium, potassium, etc. such nutritive produce goes waste in the form of banana peel. Banana peel, constituting up to 35% of the ripe fruit, are often regarded as household and industrial waste in large quantities. Currently, major aquafeed industries are dependent on replacing limited fish-based feed sources with plant sources such as cassava leaves, papaya leaves, cereal bran, banana leaves and peels, etc. as a source of dietary fiber, protein, EAA and carbohydrates to ensure nutritious, environmentally friendly, and costeffective diets for sustainable aquaculture. The proximate analysis of sun-dried banana peel flour so prepared, for its chemical composition shows strong evidence to become a good fish feed. Many scientists had reported large quantities of antioxidants (1% DM) in banana peel, e.g. dopamine in additional to these N-compounds. Potassium dominate among all other minerals which is followed by phosphorus, calcium, and magnesium in the peel of banana while iron, zinc, manganese and copper contents are found in trace amount. Potassium plays an important role in maintaining normal blood pressure and regulation of body fluids. WG and SGR were found to be superior in Etroplussurayensis and LabeoRohita as compared to the control indicating the test diet met the nutritional requirements of the fish. Various studies have demonstrated the hematological and histological responses of adding BPF to bloc hand rohu diets. Immune parameters, such as lysozyme (LA) and alternative complement pathway (ACP), phagocytic (PA) and Immunoglobulin (IgM) activities, antioxidant parameters like SOD, CAT, GPx, MDA were found to be in the optimum range. There were no histopathological changes in the muscle, gill, intestine or liver during feeding experiments. These studies were found consistent after dietary administration of plant products in common carp, Megalobrama terminalis, Ctenopharyn godonidella and Megalobramaamblycephala. This review deals with research finding on banana peel waste nutrition and its potential utility as fish feed for economic up-growth of banana and fish farmers. Keywords: Banana, peel, fish, feed, nutrients.

QTL MAPPING FOR COLD TOLERANCE WITH SPECIFIC REFERENCE TO RICE- REVIEW. I. GOPINATH¹ AND B K NAMRIBOI² ¹DIVISION OF GENETICS, IARI, NEW DELHI DEDA DTMENTE OF DI ANTE DA DIVIDA CAD

²DEPARTMENT OF PLANT PATHOLOGY, GBPUAT, PANTNAGAR

Rice is a staple food for more than half the world's population. It has highest global production next to wheat. With global climate change, most rice growing regions are experiencing extreme environmental fluctuations. Rice is susceptible to a variety of abiotic stresses including cold stress. With the present practice of monocropping loss in yield due to stress affects huge agricultural economy. In the temperate regions, rice growth is constrained by limited period that favours growth, where it needs optimum temperature between 25°C to 35°C. As the temperatures goes below 15°C, rice crop shows a wide range of chilling injury depending on the length of exposure and the

developmental stage. Seedlings subjected to prolonged exposure (*i.e.* several days to weeks) can exhibit necrosis and mortality while shorter or intermittent exposure often leads to yellowing (chlorosis) and stunting, thus greatly reducing rice yields. However, identifying QTLs associated with cold tolerance and elucidating their genetic relationship are the prerequisite for developing rice varieties with cold tolerance as a prebreeding practice or to employ as source material for gene introgression. Cold tolerance is a complex trait that is controlled by quantitative trait loci (QTL). Many QTLs related to cold tolerance at different stages such as germination, seedling, vegetative, reproductive and grain maturity have been identified by different researchers using mapping populations like recombinant inbred lines (RILs), doubled haploids (DH), F₂:F₃ lines, backcrosses and introgression lines. Therefore, the development of cold tolerant plants by the introduction of molecular breeding is assuredly a meaningful approach to hasten the breeding for improved plants. Intuitively, molecular breeding would be a faster way to mapping of beneficial QTL than through conventional breeding. The QTLs identified could be brought together by pyramiding into the breeders' material and thus reduce the negative effect of cold stress. **Keywords:** Rice; Quantitative Trait Loci, molecular breeding; cold tolerance; mapping populations, pyramiding

INSECT RESISTANCE TRANSGENIC IN VEGETABLE CROPS

MAGAR SAYALI¹, V.G. MAGAR²

¹SCHOOL OF CROP IMPROVEMENT, COLLEGE OF POST-GRADUATE STUDIES, CAU, UMIAM, MEGHALAYA

²DEPARTMENT OF HORTICULTURE, MPKV., RAHURI, MAHARASHTRA

Vegetables are grown worldwide and play a major role in human diets as they provide vitamins, minerals, dietary fibre, and phytochemicals. With increasing consumer's awareness towards nutritional benefits, vegetable consumption is rising. India, having diverse climatic conditions, soil types and varied agricultural patterns, holds second rank in world vegetable production, contributing 14% of the total world vegetable production with 169.1 million metric tonnes of production. In India, vegetable production is cultivation intensive and has poor infrastructure, due to this crop suffer from many biotic stresses. Thereby, high amount of chemical pesticides per hectare are being used for management. These pesticides even though efficient in pest reduction poses threat to the health of growers and consumers through pesticide residues as well as causes environmental pollution and ultimately, destruct ecological balance. In order to address this problem, transgenic vegetable crops can be a boon and offer many advantages such as reduced pesticide usage, health benefits, lower production costs and increased yields. Transgenic crops, commonly referred to as GM crops, enable breeders to bring favourable genes, often inaccessible by conventional methods, into elite cultivars, improving their value considerably and offering unique opportunities for controlling insects and other pathogens along with abiotic stress tolerance and quality improvement. Insect resistance genes are being obtained from sources like microorganisms, higher plants and animals. Bacillus thuringiensis toxins from bacteria, are the most widely used insect-resistant candidates, but their safety has been argued. Plant protease inhibitors used are a class of defence proteins usually present in reproductive tissues which can inhibit digestive protease activity of insect. Eg. Cp TI gene. There are four classes i.e., serine, thiol, metallo and aspartyl protease inhibitors. Alpha-amylase inhibitors affect the carbohydrate digestion in insects. Eg. Alpha- amylase inhibitors from adzuki beans. Lectin genes binds to carbohydrates including chitin and interferes with the uptake of nutrients. Eg. GNA from snowdrop. Transgenic insect resistance provides a wide range of advantages yet however, care should be taken so as to prevent resistance development due to continuous exposure of introduced genes. In India, only Bt cotton is under commercial cultivation. However, Bteggplant, GM mustard, Bt chickpea were developed to reduce pesticide use but they are still in moratorium by MOEF&CC. The emergence of plant insect-resistant genetic engineering creates a new way of getting insect resistant germplasm and breeding new varieties with insect resistance that can be integrated with other IPM strategies.

Keywords: GM Crops, Bt, Protease inhibitors, Insect resistance

PHYSIOLOGICAL BASIS OF SEED DETERIORATION

MADHURIMA BEZBORUAH

DEPARTMENT OF SEED SCIENCE AND TECHNOLOGY, ASSAM AGRICULTURAL UNIVERSITY JORHAT-13, ASSAM

During storage, a number of physiological and physicochemical changes occur, termed aging (Sisman, 2005). Seed deterioration is a complex and an inevitable physiological process leading to loss of viability and or seed vigour during various post harvest treatments including storage in adverse conditions. It does not differ substantially from degeneration or the senescence and include all the progressive detrimental changes that occur in seeds as they die (Kapoor et al., 2010). Annual losses due to deterioration can be as much as 25% of the harvested crop. It is one of the basic reasons for low productivity (Shelar et al., 2008). Seed ageing is influenced by two environmental factors, RH and temperature. The deterioration of the stored seed is a natural phenomenon and the seeds tend to lose viability even under ideal storage conditions The rate of seed deterioration is influenced by environmental as well as biological factors and varies by species, variety and seed lot. Environmentally, high temperatures during storage enhance seed deterioration, as does high moisture content. Several environmental factors contribute to seed deterioration and these conditions make very difficult to maintain viability during storage. Seed quality is depends upon initial seed quality, temperature, moisture content and mycoflora. Rapid deterioration occurs due to these environmental conditions make very difficult to maintain its viability during storage. However, the seed quality and viability during storage depend upon the initial quality of seed and the manner in which it is stored. Seed deterioration is associated with various cellular, metabolic and chemical alterations including lipid peroxidation, membrane disruption, DNA damage, impairment of RNA and protein synthesis and cause several detrimental effects on seed. Deterioration caused by field weathering is directly related to seed exposure to adverse conditions. Seeds are highly susceptible to damage and mechanical injury during post-harvest handling. Autooxidation of lipids and increase in the content of free fatty acids during storage period are the main reasons for rapid deterioration of seed.

Seed quality, germination, vigor and viability are highly influenced by environmental factors in field and storage. There was a distinct reduction in yield, seedling growth, loss of capacity to germinate and increased susceptibility to environmental stresses which cause numerous harmful effect on seed quality.

Keywords: Deterioration, Field weathering, Lipid peroxidation, Membrane disruption

EFFECT OF INTEGRATED NUTRIENT MANAGEMENT ON GROWTH, YIELD, QUALITY OF CABBAGE AND PHYSIO-CHEMICAL PROPERTIES OF SOIL

SHWETA YADAV¹, VIVEK ANUMALA¹, PRANABJYOTI SARMA¹

¹DEPARTMENT OF VEGETABLE SCIENCE, COLLEGE OF HORTICULTURE AND FORESTRY, CENTRAL AGRICULTURAL UNIVERSITY, PASIGHAT, ARUNACHAL PRADESH

Integrated nutrient management (INM) is a way to maintain and sustain soil fertility by judicious use of organic and inorganic sources of fertilizers which helps in increasing the efficiency of nutrient uptake by plants. In cabbage, it has been reported that the growth attributes like plant height, number of leaves per plant and stalk height were found significantly increased by combined application of full recommended dose of nutrients along with manure (FYM/vermicompost) and biofertilisers (azotobactor/rizobium). Similarly, yield attributes including weight of head, volume of cabbage, polar diameter and compactness were also found significantly increased by combined application of manures and biofertilizers. The combined applications of manure and biofertilisers shows significant increase in soil organic carbon over control. However, there is non-significant relation of combined applications on soil pH, electrical conductivity and bulk density. Ascorbic acid content decreases in combined application with vermicompost at the rate of 25 tha⁻¹. It is because when a plant is exposed with more of nitrogen there is increase in protein production and reduction in carbohydrate production and vitamin C is made from carbohydrate hence the synthesis of vitamin C reduced with high dose of nitrogen fertilizer. Therefore, it can conclude that the treatments which received 75% of N and P shows better yield as compared to 50 % application of recommended N and P irrespective of integration with organics (vermicompost and FYM) or bacterial inoculation.

Key words: Integrated nutrient management, Cabbage, Biofertilizers

EFFECT OF STUBBLE BURNING

SHWETANSHU PRIYA¹, OM KASHYAP², VIVEK ANUMALA³

¹DEPARTMENT OF SOIL SCIENCE AND AGRICULTURAL CHEMISTRY, PALLI SIKSHA BHAVANA, VISVA-BHARATI, BOLPUR, WEST BENGAL

²DEPARTMENT OF SILVICULTURE AND AGROFORESTRY, SAM HIGGINBOTTOM UNIVERSITY OF AGRICULTURE, TECHNOLOGY AND SCIENCES, PRAYAGRAJ, UTTAR PRADESH

³DEPARTMENT OF VEGETABLE SCIENCE, COLLEGE OF HORTICULTURE AND FORESTRY, CENTRAL AGRICULTURAL UNIVERSITY, PASIGHAT, ARUNACHAL PRADESH

Stubble burning is a process of setting up crop residues on fire in order to clear the field for the next season crop. It is practiced by the farmers particularly belonging to the states of Punjab and Haryana. In this region, many farmers use combine harvester for harvesting purpose. Combine harvester is a multipurpose machine that serves for harvesting reaping, threshing and cleaning, it is used in farm mechanization saving labour involvement and cost, after harvesting crop residue is left in the form of stubbles particularly in rice and wheat fields because it cuts only upper two-third portion of the shoot comprising economic portion. It has been reported that rice and wheat crops constitute about 51% and 27% respectively of total crop residues produced per year. Burning of these residues create cloud of toxic gases, according to a study it has been reported that 149.24 million tonnes of carbon dioxide, over 9 million tonnes of carbon monoxide, 0.25 million tonnes of oxides of sulphur and 1.28 million tonnes of particulate matter are released into the environment due to stubble burning the effect of which can be seen in the Delhi where the Air Quality Index raised to extremely unhealthy level and it has also been reported that 46% of Delhi's pollution caused by stubble burning. Moreover it also causes nutrient loss, as 25% of nitrogen and phosphorus, 50% of sulphur and 75% of total uptake are stored in the crop residues. According to a report, 5.5 kilograms of nitrogen, 2.3 kilograms of phosphorus, 25 kilograms of potassium and more than 1 kilogram of sulphur are lost per tonne of stubble burnt. Further burning of stubbles heat up the upper layer of the soil which damages useful micro-organisms, and also affects soil fertility by the removal of organic manure. There is a desperate need to exert tremendous efforts from the side of scientists, agriculturists, engineers and other regulatory authorities that they must strategically work together to prepare plan of work for the management of crop residues, develop appropriate regulations and technologies to tackle this menace, ultimately promoting human health and controlling global warming. Keywords: stubble burning, combine harvester, air pollution, fertility, global warming

UNDERUTILIZED AND NEGLECTED CROPS: THE HIDDEN TREASURES FOR THE CHANGING AGRICULTURAL SCENARIO- A REVIEW

KOLLOL PRATIM BARUAH¹ AND BIDISHA HAZARIKA²

DEPARTMENT OF PLANT PATHOLOGY¹ AND DEPARTMENT OF TEA HUSBANDRY & TECHNOLOGY² ASSAM AGRICULTURAL UNIVERSITY, JORHAT-13, ASSAM

With the projection of the world population crossing the 9 billion mark by the mid-21st century, it will cause a serious scarcity of food, energy and water. Demand for all this is expected to increase up to 70 and 100 percent respectively while the demand for fresh water will rise up to 30 percent. With the aim to cater to the growing need of the global population in the 20th century, the scientific community across the world came up with the Green Revolution, spearheaded by Dr. Norman Borlaug. But this revolution predominantly gave emphasis to only 4 major food crops- rice, wheat, maize and soybean. This narrow diet has had major consequences to the human and soil health in due course of time. Underutilized crops (UUC) are the very less acquainted crop species with respect to production and scientific research that are well adapted to stress conditions. These crops adds to the food and nutritional stability. There are reports proving their superiority to staple crops. UUC's like amaranth, buckwheat and chenopods are found to be far richer in protein contents as compared to rice and wheat. Besides, integration of a vertical farming approach for some high valued underutilized crops in the near future can very well lead to a profitable farming business for the small and marginal farmers which are scattered all around developing countries like India. But there are certain issues like limited germplasm availability, lack of technical support and interest by the producers due to its low productivity that needs to be addressed at the earliest. In the long run, these UUC's are going to be the treasures for the future generation in terms of food and security, income generation and environmental services.

Key words: Ecological stability, Food security, Green revolution, Health benefits

NUTRACEUTICAL BENEFITS OF FRUITS AND VEGETABLES AND THEIR ROLE IN OXIDATIVE STRESS MANAGEMENT

VIVEK ANUMALA¹, JOME RIME², MEGHA RAGHAVAN², PRANABJYOTI SARMA¹

¹DEPARTMENT OF VEGETABLE SCIENCE, COLLEGE OF HORTICULTURE AND FORESTRY,

CENTRAL AGRICULTURAL UNIVERSITY, PASIGHAT, ARUNACHAL PRADESH

²DEPARTMENT OF FRUIT SCIENCE, COLLEGE OF HORTICULTURE AND FORESTRY, CENTRAL AGRICULTURAL UNIVERSITY, PASIGHAT, ARUNACHAL PRADESH

A nutraceutical is any substance that is a food or a part of a food and provides medical or health benefits, including the prevention and treatment of disease. Natural therapy has emerged as new concepts of health aid in recent years benefitting mankind. With the change in time human food habits are also changing, some have a better conscious of their diet while others consider taste as their priority leading to the consumption of junk and unhealthy foods causing oxidative stress. Oxidative stress is a condition of excess free radicles and less antioxidant scavengers resulting in uncountable problems like aging, acidity, gastric and diseases like cancer, heart problems, liver inflammation, weak immune and nervous system. Managing oxidative stress is a great challenge to mankind in present scenario and for that, nutraceuticals may be the wise option due to the presence of phytochemicals with no side effects when compared to Pharmaceuticals. Consumption of fruits and vegetables such as apple, strawberry, citrus fruits, roselle and carrot, beetroot, broccoli, coloured leafy vegetables respectively are highly recommended by Indian Council of Medical Research as they are rich in antioxidants(phytochemicals) in the form of anthocyanins, carotenoids, xanthophylls, minerals, ascorbic acid, and other vitamins which can modify metabolic activity by altering physiological process within human system, aiding in detoxification of various toxins and prevent degenerative oxidation by scavenging free radicals. Other sources of nutraceuticals may range from isolated nutrients, dietary supplements, genetically engineered designer foods, herbal products, functional foods and enriched processed foods such as soups and beverages, but the most commonly available and rich source of nutraceuticals are fruits and vegetables. Nutraceuticals have proven health benefits as they are reported to play specific pharmacological effects in human health and their consumption (within their acceptable Recommended Dietary Intakes) will keep diseases at bay and allow humans to maintain overall good health by preventing diseases which are always believed to be better than cure. Key words: nutraceutical, oxidative stress, phytochemicals, free radicals, disease prevention, etc.

CONSERVATION OF INSECT POLLINATORS, A GROWING CONCERN TO MAINTAIN ECOLOGICAL BALANCE FOR THE FUTURE

GOURANGA CHETIA¹, PARTHIBAN M², SAHIDUR RAHMAN³

¹²³DEPARTMENT OF ENTOMOLOGY, ASSAM AGRICULTURAL UNIVERSITY, JORHAT-785013, ASSAM INDIA

Pollinators are animals that fertilize plants, resulting in the formation of seeds and the fruit surrounding seeds. Among the vast diversity of pollinators most are insects. For example, while there are only about 1,000 vertebrate pollinator species, it's estimated that there are at least 16,000 different species of bees world-wide. Pollinator conservation is the process of safeguarding or enhancing the diversity of pollinators that are facing a decline in population. Over 40% of insect species are threatened with extinction. Lepidoptera, Hymenoptera and dung beetles (Coleoptera) are the taxa most affected. Recent studies in the US it is seen that there is loss of 30-40% of commercial honeybee colonies, which has occurred since 2006, was linked to "colony collapse disorder", a syndrome characterized by disappearing worker bees. The iconic monarch butterfly has experienced declines of 74-80% in populations both east and west of the Rocky Mountains. The causes of loss include land-use change with the consequent loss and fragmentation of habitats, increasing pesticide application and environmental pollution, decreased resource diversity, alien species, the spread of pathogens and climate change. Most wild plant species (80%) are directly dependent on insect pollination for fruit and seed set. Insect pollination, mostly by bees, is necessary for 75% of all crops that are used directly for human food worldwide. According to FAO, UN 40% of invertebrate pollinator species, particularly bees and butterflies are facing extinction. Pollinator populations decline in many parts of the world put agricultural productivity and the health of natural ecosystems at risk. Considering the potential global effect of pollinator population decline, efforts should be made to properly monitor the pollinator population dynamics and need for their conservation. Here we discuss the scenario of current status of conservation of insect pollinators and different methods like protecting habitat and increasing available habitat, Providing a diversity of native plants that bloom from early spring through late fall will ensure that resources are available to pollinators. Installing and enhancing habitat corridors to improve habitat connectivity to bring back the pollinators.

Key words: Pollinator, conservation, decline, Lepidoptera

STUDY ON EFFICCACY OF BACTERIAL BIOCONTROL AGENTS ON NEMATODES IN BANANA SENTHILKUMAR THANGAVELU

HORTICULTURAL RESEARCH STATION, PECHIPARAI, KANNIYAKUMARI - 629 161, TAMIL NADU

Field experiment on management of nematodes in banana was conducted to assess the efficacy of plant growth promoting rhizobacteria, single and combined application of Pseudomonas fluorescens and Bacillus subtilis. All the treatments were significantly increased the biometric characters viz., stem girth, plant height and number of leaves per plant and observed that the reduction of nematode population in root system. Eighty six per cent of nematode population was reduced from the initial nematode population recorded in combined application of P. fluorescens (Pfbv 22) + B. subtilis (Bbv57) each 12.5 g/plant respectively compared to untreated control followed by single soil application of P. fluorescens (Pf1) @ 25/ plant recorded lowest nematode population compared to untreated control. **Key words:** Banana, nematode, biocontrol agents

EVALUATION OF ECO-FRIENDLY MANAGEMENT TACTICS AGAINST ROOT KNOT NEMATODE *MELOIDOGYNE INCOGNITA* IN TUBEROSE

SENTHILKUMAR THANGAVELU

HORTICULTURAL RESEARCH STATION, PECHIPARAI, KANNIYAKUMARI - 629 161, TAMIL NADU

A field experiment was conducted to study the bio control potential on root knot nematode management using commercially available talc formulation of *Paecilomyces lilacinus, Pochonia chlamydosporia,* growing of marigold and neem cake along with chemical check Carbofuran 3G and compared with untreated control under root knot nematode sick field. The biometrical observation, nematode

population and flower yield were recorded at the time of termination of experiment. The results revealed that the combined application of soil (2.5 kg/ha) and bulb (1 kg/ha) of *Pochonia chlamydosporia* significantly reduced the nematode population in soil (47.3 %) and root (49.1 %) compared to other treatments. The application of *Pochonia chlamydosporia* in soil (2.5 kg/ha) and bulb (1 kg/ha) recorded the highest flower yield (43.5%) and spike length (63.7 cm) when compared to untreated control. **Key words:** Tuberose, root knot nematode, biocontrol agents, *Meloidogyne incognita*

APPRECIABLE CONSEQUENCES OF BAY LEAF FARMING IN PITHORAGARH

RAHUL KUMAR^{1*}, MANISH RAJ¹, KANHAIYA LAL¹, MD. RASHID ASHRAFI¹

DEPARTMENT OF AGRONOMY,BIHAR AGRICULTURAL UNIVERSITY,SABOUR,BHAGALPUR, 813210,BIHAR

Under Indian context, the prosperity of a country depends upon the welfare of farmers and majority of the Indian farming communities follow traditional norms of agriculture which support their livelihood. Farming in India is characterized by small, marginal, and fragmented land holdings (about 86 per cent) and is highly depended on monsoon showers. Operating small holdings is often unviable and in this situation, farming is not a profitable business or enterprise. In the context of Bihar, major challenges and issues in agriculture are the occurrence of flood, drought and hail storm as well as high cost and meager availability of quality seeds, fertilizers, irrigation, lack of marketing facility, low storage, and processing facilities etc. Therefore, there is an urgent need of transformation in agriculture production combined with IFS approaches that involves crop cultivation, dairy, poultry, fishery, mushroom cultivation etc.For doubling of the farmer's income few vital strategies need to be adopted considering the basic requirements of the farmers. These strategies might be massive investments in agricultural research and development, adoption of GAP, conservation agriculture technology, implementation of farmers friendly policies, judicious use of available resources and inputs, along with improved market and transportation facility, minimum support price reform, supported by adequate and timely availability of bank credits. It has been reported that a rise in MSP will raise farmer income by 13-26 per cent. Smart farming and credit supporting smart farming are other possible strategies in doubling farmer's income.REconomic and socioecological access to sustainable production could be only ensured by adopting farming system approach. **Key words: GAP, IFS, MSP reform, Smart Farming**

SPATIAL DISTRIBUTION OF HEAVY METALS IN SEWAGE IRRIGATED PERI -URBAN AREA OF MOHINDERGARH CITY OF MOHINDERGARH DISTRICT, HARYANA, INDIA

RAJPAUL¹ AND VINAYAK V SAVANOOR¹

¹DEPT. OF SOIL SCIENCE, CCS HARYANA AGRICULTURAL UNIVERSITY, HISAR, HARYANA, INDIA

A field survey and laboratory study on "Spatial distribution of heavy metals in sewage irrigated peri -urban area of Mohindergarh city" was conducted during 2018-19 to investigate the effects of sewage water on physical and chemical properties of soil. In this study, soil, water and vegetables/crops samples using GPS were collected from peri-urban area of Mohindergarh and Narnaul cities by following random sampling method and analyzed for physico-chemical properties, DTPA extractable and total heavy metals uptake, total phenolic content and quality parameters in respective samples. In soil, chemical properties like EC, OC and CEC found to be higher in sewage irrigated soils compared to tube well irrigated whereas pH and CaCO₃ higher in tube well irrigated than sewage irrigated soils of the study area and DTPA extractable Zn content was higher followed by Cu>Pb> Ni> Cr> Co> Cd in sewage irrigated soils than tube well irrigated soils and found within the permissible limit. Heavy metals followed the decreasing trend with increasing depth in soil profiles of both the cities in both soils except Ni. In different plant samples, Zn got maximum accumulation followed by Pb than other heavy metals in both sewage and tube well irrigated soils except spinach and all the heavy metals were found within the permissible limit except Cr at some sites in cabbage, brinjal and okra. In sewage and tube well water samples, Zn and Cu were detected out of which Zn found in higher concentration and rest of the metals not detected. Total phenols content in sewage and tube well waters of Mohindergarh ranged from 13.2 to 22.8 and 2.4 to 7.2, respectively. With the help of Pearson's correlation coefficient, the relationship of different physico-chemical properties with micronutrients and heavy metals contents in soil were determined and found that negative correlation between pH and all heavy metals, significant positive correlation between pH and CEC; EC with CEC and clay content; clay with EC, OC, CEC and silt content; Co with silt content, Cu, Cr, Pb and Ni.

Key words: EC, GIS, pH, phenolic, OC, DTPA

COLD PLASMA TECHNIQUE (CPT): A NOVEL APPROACH FOR BETTER STORAGE LIFE OF FRUITS AND VEGETABLES

VAISHALI GUPTA, NIRMAL KUMAR MEENA, KALPANA CHOUDHARY AND INDRARAJ GHASIL COLLEGE OF HORTICULTURE AND FORESTRY, AU, KOTA, JHALARAPATAN, JHALAWAR,- 326 023 (RAJASTHAN)

Fruits and vegetables are mainly consumed as fresh form and demand is continuously increasing due to consumer consciousness for health. Fruits and vegetables are loaded with various micro-organisms which is concern of food safety. There are many techniques used to reduce this load like sterilization, pasteurization, use of sanitizers. Cold plasma techniques is emerging techniques to reduce microbial load. This is a non-thermal technique which uses cold gases at temperature below 40°C to sanitize fresh products, processed products or any other contaminated surface. Cold Gases could be normal air, nitrogen or noble gas mixture which may be ionized by electricity or lasers. This technique alters/ destroys cell membrane, internal cellular components and DNA strands of microbes with radicals, charged species and ultra violet radiations and thus it helps in extending the storage life of produce by reducing pathological loads, deactivation of enzymatic reaction. It is an eco- friendly approach which avoids the use of chemicals and leaves no residue. It has negligible impact on nutritional and sensory attributes of produce and that's how it is superior to conventional methods of preservation/ sanitization which have negative effect on sensory and nutritional attributes of produce. It is useful in sanitizing surface of apple, strawberry, blueberry, kiwi fruit, melon cherry tomato, carrot, cucumber etc. by cold ionized gases.

Key words: cold plasma; non-thermal; ultra violet; nutritional; sensory
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INDUCTION OF GENETIC VARIABILITY IN SOYBEAN FOR DISEASE RESISTANCE AND YIELD AND ITS CONTRIBUTING TRAITS BY GAMMA RAYS

S. R. KAMDI, M. P. MESHRAM, G. A. KANKAL, SHUBHANGI KAMDI, SILPA RANANAVARE, J. R. KATORE, S. S. BHURE AND J. M. PARBAT

COLLEGE OF AGRICULTURE, MAHARAJBAG, NAGPUR, DR. PANJABRAO DESHMUKH KRISHI VIDYAPEETH, AKOLA (M. S.)

Induced mutagenesis has been recognized as the most efficient method for induction of morphological and genetical variability in soybean crop because it is self pollinated crop having very small size of flowers which is very difficult for crossing programme. Three different doses of gamma rays i.e. 200 Gy, 250 Gy, 300 Gy (Co⁶⁰) were used to induce morphological and genetical variability for disease resistance and yield and its contributing traits. Total 62 YMV free mutants having desirable yield and its contributing traits were identified and selected in M₂ generations. Similarly, total 104 root rot free mutants having desirable yield and its contributing traits of M₃ generation were selected and harvested separately. Effectiveness and efficiency of mutation treatment was recorded at increase for low concentration and decrease for high concentration level. The most of the treatment were exhibited positive and negative shift. The statistical analysis such as high phenotypic coefficient of variation (PCV) and genotypic co-efficient of variation (GCV) and low to high heritability (h²) and low to high genetic advance as a percentage of mean was recorded for all five characters studied i.e. plant height, number of branches plant⁻¹, number of pod plant⁻¹. 100 seed weight and seed yield plant⁻¹ in M₃ and M₄ generations. This indicated that all these traits where influenced by additive gene action operating in the expression of these traits in M₃ and M₄ generation and hence help as a criteria for making selection. **Key words:** Soybean, Disease Resistance, Mutation, Effectiveness, Efficiency, Frequency

IMPACT OF LIVE MULCH IN CROP PRODUCTION RUPINDER SINGH¹, SIMTA SHARMA¹

Department of Agriculture, Sri Guru Granth Sahib World University, Fatehgarh Sahib

In recent years, the adverse effects of chemical fertilizers and pesticides on environment have been greatly concerned and led to more attention about negative impacts on ecosystems such as soil, water pollution and phytotoxic effects on rotational crops. So, ecological approaches are considered for modify these problems and achievement the sustainability in agriculture. One of the effective ways to achieve this objective, by using live mulch. Living mulch is generally crop interplanted or under sown with a main crop and intended to serve the purposes of a mulch to supress weeds and to provide nutrients. It prevents the formation of surface crust which in turn increases soil infiltration rate. It is used as an important tool for integrated nutrient management system. Brown manuring in conjunction with pre-emergence herbicides significantly improves the soil physico-chemical properties viz., organic matter, soil aggregation, available nitrogen, concentration of available nutrients in the root zone and reduces the bulk density, N-losses through leaching and soil erosion. Brown manuring can replace 25 per cent of nitrogenous fertilizer with the overall improvement of soil health (Iliger *et al.*, 2017). It aimed at suppressing the weeds by its competitive nature and shade effect. Rice with *Sesbania*, knockdown at 4 and 5 weeks after sowing recorded less weed density and weed dry matter compared to sole rice (Iliger *et al.*, 2017). Grain yield, ear dry weight, biological yield, number of grains per ear was achieved higher in treatments clover + wheat (Fakhari *et al.*, 2018). The use of live mulch can be considered as an effective method in sustainable agriculture through reducing herbicide use, improving soil health and increasing crop yield. **Key words:** brown manuring, live mulch, Herbicide, Fertilizer

IMPACT OF ORGANICS IN MAINTENANCE OFss SOIL HEALTH SIMTA SHARMA¹, RUPINDER SINGH¹

¹Department of Agriculture, Sri Guru Granth Sahib World University, Fatehgarh Sahib

Soil health is defined as continued capacity of soil to function as a vital living system. It contains biological elements that are key to ecosystem function within land use boundaries. Before1950s, farmers relied purely relied on organic inputs for crop production. Due to increased population in India, this exerted great pressure on land and traditional farming systems due to huge demand of food grains. Many of the gains in production during the last five decades resulted from "Green Revolution". Over the years, farmers increased their reliance on fertilizers and reduced the use of organic manure drastically. Low levels of soil organic matter along with multi-nutrient deficiencies are the major problems for bridging yield gap in Indian agriculture. Soil health recently captured the attention of farmers as poor soil health from intensive cultivation, mechanization, limited crop rotations and lack of organic matter. This has often led to increased soil compaction, erosion, greater pest problems, diseases, decreased infiltration, reduced water holding capacity and crop productivity. At present, there is a need for developing an efficient nutrient management system with the use of organic inputs to reduce the soil health problems. Organics encourage the formation of crumby soil structure, thus improving soil drainage, infiltration, and aeration. Organic inputs though carry low nutrient contents and are slow releasing but produce favourable effects on soil properties and add organic matter to the soil. Organic inputs also modify soil physical properties, increase biological activities, helps plants to quick uptake of nutrient, increase nutrient, reduces soil pollution and soil erosion.

Key words: Fertilizers, crop productivity and organics.

STATUS OF BEGOMOVIRUSES INFECTING CUCURBITS IN EASTERN INDIA RANVEER KUMAR, SRINIVASARAGHAVAN A. DEPARTMENT OF PLANT PATHOLOGY, BIHAR AGRICULTURAL UNIVERSITY, SABOUR-813210, BHAGALPUR (BIHAR)

The cucurbits belonging to family Cucurbitaceae are considered a key source of carbohydrates, vitamins and minerals. In India Cucurbitaceous vegetables are an important part of diet throughout year, India produces about 54.68 lakh tonnes of Cucurbits including pumpkin, squash, gourd, cucumber and melons over an estimated area of 5.64 lakh ha. among different factors of yield loss caused in cucurbits, white-fly transmitted begomoviruses are most common which comes under Geminiviridae. to know the present status of begomovirus in eastern part of the India, A total of 41 location under Bihar, Jharkhand and adjoining region of Uttar Pradesh were surveyed to unearth the status of begomovirus like symptoms on different cucurbits field of farmers. the symptomatic plant parts were also

collected for further processing to confirm the begomoviruses variability. among all the locations Maximum disease severity was present at Nawada in Bottle gourd crop with 48 percent severity, followed by cucumber at Bhagalpur and Sponge gourd at Banka having with 43.60 and 43.30 percent severity. Survey results clearly indicate that, apparent symptoms of begomoviruses have been observed across all the surveyed location with moderate to severe incidence as well as severity. The incidence of the disease at all the location was observed to be higher as compared to severity indicating the recent and continuing infection. A huge amount of symptomatic variability was revealed within and among the crops and locations. The conspicuous symptoms observed were, yellowing, mild to severe mosaic, mottling, curling, vein clearing, puckering, crinkling, rossetting, leaf distortion, stunting, cupping etc. in mild severe form. All the 41 isolates originating from cucurbits exhibiting various symptoms were found positive for presence of begomovirus. Out of 41 isolates tested 37 were found to be ToLCNDV and two isolates were similar to Melon yellow leaf curl virus DNA A and one each was found similar to ToLCPMV and ToYLCV.

IMPACT OF WIDE RANGE OF MEDIA AND PH ON VEGETATIVE GROWTH OF *PLEUROTUS EOUS* AND *PLEUROTUS FLORIDA* MUSHROOMS

MANPREET KAUR¹, S. K. MISHRA¹ AND GOURAV KUMAR²

¹DEPARTMENT OF PLANT PATHOLOGY, ²DEPARTMENT OF ENTOMOLOGY, COLLEGE OF AGRICULTURE, G.B. PANT UNIVERSITY OF AGRICULTURE AND TECHNOLOGY, PANTNAGAR-263145, UTTARAKHAND, INDIA

Laboratory and crop room based experiments of the were conducted at Mushroom Research and Training Centre, Department of Plant Pathology, College of Agriculture of G.B.P.U.A &T, Pantnagar during 2017-2018. *Pleurotus* mushroom is the second largest mushroom world over for both production and consumption. Many species of that grow at commercial level. Among them *Pleurotus eous* and *Pleurotus florida* are one of the important mushrooms. It grows fast on the various organic residues of agricultural and forest origin. The cultivation of *Pleurotus* mushroom broadly depends on mushroom species, environmental factors and kind of substrates used. Therefore, the present experiment was carried out to evaluate the effects different media and pH on vegetative growth of *Pleurotus eous* and *Pleurotus florida*. During *in vitro* study, the effect of media (Oat Meal Agar, Malt Extract Agar, Potato Dextrose Agar, V8 juice Agar, Czaapecks Dox Agar) and pH (4, 5, 6, 7, 8) were evaluated against the vegetative growth of *Pleurotus eous* and *Pleurotus florida*. It was found during the study that the mycelium growth of *Pleurotus eous* was increased by 11.25%, 2.90% and 7.33% with the Oat Meal Agar medium at pH 6, respectively over to the respective checks. However, mycelium growth of *Pleurotus eous* was found highest by 88.50 mm in the check itself then the rest treatments. In case of *Pleurotus florida*, the Malt Extract Agar medium and pH6 were found most suitable to increase mycelium growth by 24%, 15.58%, 5.93% and 19.81%, respectively in comparison to their checks.

CHARACTERIZATION OF *BIPOLARIS SOROKINIANA* ISOLATES INFECTING BARLEY AND IDENTIFICATION OF *BSTOXA* GENE

*GUFRAN AHMAD¹ MOHD SALMAN² ARSHAD HUSSAIN³ NISHAR AKHTAR¹

¹BANARAS HINDU UNIVERSITY, ²HNB GARHWAL UNIVERSITY 3ALIGARH MUSLIM UNIVERSITY

Barley (*Hordeum vulgare* L.) is self-pollinated, annual monocotyledonous grass, belonging to tribe Triticeae, family Poaceae (also known as Gramineae). Barley is unique among the Triticeae as it contains both annual species such as *H. vulgare*, *H. marinum* and perennial species such as *H. bulbossum* (Von Bothmer, 1992). The pathogen*Bipolaris sorokiniana* (Sacc.) shoemaker (*Drechsler* ex Dastur, syn. *Helminthosporium sativum*). The teleomorphic stage (perfect stage) of the *B. sorokiniana* is *Cochilobolus sativus* (Maraite *et al.*, 1998), which is the hemi-biotrophic fungus causing the spot blotch or leaf blight of barley act as the major constraint in the production and quality of the crop and its threat is ever increasing in the world lead heavy losses varying from 6 to 53 % on susceptible cultivar(Vaish *et al.*, 2011). A survey was conducted at different location of Uttar Pradesh, Madhya Pradesh and Karnataka. Total 43 isolates from spot blotch infected leaves of barley were collected. Single spore isolation and purification was performed as per existing standard procedure. On the basis of colony type, all 43 isolates were divided into two group's *viz.*, mixed and black. Amongst 43 isolates, 39 isolates belonged to mixed group whereas remaining 4 isolates belonged to black group. From this study it can be concluded that occurrence of mixed type of isolates was more frequent than black in case of *B. sorokiniana* infecting barley. Also observed that there is lack of white isolates in barley unlike wheat infected by *B. sorokiniana*. Also found that the three isolates in which *BsToxA* was found were all of black type. As cultivar carrying *Tsn1* locus in their genome is more susceptible to disease in corresponding to pathogen *B. sorokiniana* carrying *ToxA* gene. So, there is need to screen for the occurrence of *Tsn1* in Asian barley cultivars. Removal of *Tsn1* gene from cultivated barley will help in imparting global food security and will also help in preventing losses faced by farmers.

Key word: viz., That is, ToxA gene, Tsn1 locus,

LAND POTENTIALITY INVESTIGATION FOR AGROFORESTRY PURPOSE USING REMOTE SENSING AND GIS *FIROZ AHMAD^{1*}, NAZIMUR RAHMAN TALUKDAR,^{2, 3,} PRAKASH CHANDRA DASH⁴, SUNIL PRATAP KUMAR⁴, LAXMI GOPARAJU⁵ FIROZ AHMAD⁵ & ¹NISHAR AKHTAR

¹BIRSA AGRICULTURAL UNIVERSITY, KANKE, RANCHI, JHARKHAND, INDIA ² WILDLIFE CONSERVATION LABORATORY, DEPARTMENT OF ECOLOGY AND ENVIRONMENTAL SCIENCE, ASSAM UNIVERSITY, SILCHAR, INDIA-788011 ³CENTRE FOR BIODIVERSITY AND CLIMATE CHANGE RESEARCH, UDHAYAN, HAILAKANDI-788155, ASSAM ⁴XAVIER INSTITUTE OF SOCIAL SERVICE (XISS), RANCHI, JHARKHAND ⁵VINDHYAN ECOLOGY AND NATURAL HISTORY FOUNDATION, MIRZAPUR, UTTAR PRADESH, INDIA

The study applied the soil, land and topographic data for analyzing the potentiality of land for trees /crops suitability in the Gumla district of Jharkhand, India. The remote sensing, GIS and GIS modeling techniques were used to achieve the goal. The soil fertility, soil wetness, and slope map are scientifically produced and integrated to find out the landscape suitable categories for prioritization of trees/crops scaling in the agroforestry domain. Additionally, we have examined the drift of loss of soil wetness using satellite data from monsoon to post-monsoon period up to the village level.

The analysis logically revealed the potentially suitable landscape (28%: high; 38%: medium; 25%: low and 9%: very low) for tree/crop farming. The seasonal drift of soil moisture loss after monsoon season was found highest in village Mahugaon followed by Pahladpur, Jalka, Itkiri, Shiwserang, and Gamhariya. Furthermore, 40% of the total villages of the study area showed soil wetness loss from medium to

very high during the same base period which needs intensive soil and water conservation measures at the watershed level to conserve seasonal rainwater. These efforts will improve the soil moisture and water availability for plants and support significantly in extending agroforestry exercise/design/ management locally.

Such analysis/results are one of the potential research gaps can be harnessed for the betterment of cultivators/farmers in the tribaldominated region using local knowledge for designing appropriate agroforestry practices/models and can be incorporated in various ongoing and future projects.

Keywords: Land potentiality; Remote sensing &GIS; Soil fertility; soil wetness; Jharkhand.

INVIVO STUDIES ON THE EFFICACY OF GARLIC CLOVE EXTRACT WITH AND WITHOUT SOME OTHER EFFECTIVE BOTANICALS AGAINST *BIPOLARIS SOROKINIANA* (SACC.) SHOEM CAUSING SPOT BLOTCH OF BARLEY

*NISHAR AKHTAR¹, ZEESHAN MAZHAR¹ AND SHYAM SARAN VAISH¹

¹DEPTT. OF MYCOLOGY AND PLANT PATHOLOGY, BANARAS HINDU UNIVERSITY, VARANASI (U.P.)

Indiscriminate and overzealous use of synthetic chemicals in combatting plant diseases have resulted in imbalance in ecology and food chain which ultimately effects human health, so a study was carried out at Department of Mycology and plant pathology, Institute of Agricultural sciences, BHU, Varanasi on *invivo* efficacy of garlic clove extract and its blend with other potent botanicals viz., neem, datura, eucalyptus at different concentration against spot blotch of barley caused by *Bipolaris sorokiniana* that has emerged as a serious disease specifically in warm and humid parts of world. The efficacy of these botanicals were compared to that of Propiconazole @ 0.1% The data revealed that double spray of garlic clove extract @ 10% (T4) as well as double spray of a blend of neem, datura and eucalyptus along with garlic mixed in ratio 1:1 @10% (T2) at an interval of 10 days was similar to reduction following single spray of Propiconazole (Tilt) @ 0.1% (T13).

Keywords: Invivo, Propiconazole, Tilt, Garlic clove, Bipolaris sorokiniana

EFFECT OF DISTINCT BIOCONTROL AGENTS ON OKRA (*ABELMOSCH USESCULENTUS* MONECH) FOR THE SELECTION OF PUTATIVE STRAIN

SONY GRACE¹, MOHAMMAD SALMAN¹ DR. DEEPTIPRABHA1, DR. J S CHAUHAN1 AND GUFRAN AHMAD2 1DEPARTMENT OF SEED SCIENCE AND TECHNOLOGY. H.N.B. GARHWAL UNIVERSITY 2 DEPARTMENT OF MYCOLOGY AND PLANT PATHOLOGY, BHU VARANASI

Okra (Abelmoschus esculentus Monech) known as Bhindi or lady's finger. Okra belongs to the family malvaceae having chromosome no. 2n=130. There are 38 species under the genus Abelmoschusand is a warm season vegetable grown in the the world. The origin of okra is somewhere in African continent. It is one of the most popular because of its easy cultivation quick growing habit short duration dependable yield and its adaptability to various conditions for its tender green pods used as vegetables though sometimes canned and dehydrated. There is substantial scope for enhancing yield of Okra to meet the increasing demands by adoption of new techniques such as using proper combination of different biocontrol agents. With this consideration, the present studies entitled "To Study Effect of Biocontrol Agents on Growth of Okra (Abelmoschus esculentus (L.) Moench". Okra seed of variety Arka komal was use in the research.Selection of putative strain was performed by Five bio control agents Bacillus 218 and Pseudomonas Y-19., FP-37., FP-11., S-90., were examine in Towel paper test to check its effects in Okra as Treatment-1, 2, 3, 4 and 5 respectively. The seeds were placed in germinator at 25 °C temperature for ten days. During this period data for germination was recorded after 2nd, 4th, 6th, 8th and 10th day with three replications each consist of 25 seeds. These three bioagents namely Bacillus-218, Pseudomonas strain FP37 and S90 singly and with their combination were further used in laboratory and field.In laboratory germination test were carried out by the towel paper method. Moist towel papers were used as a substratum to conduct.75 seeds for each treatment with three replications each consist of 25 seeds, and placed in seed germinator at cylindrical position for 10 days at 25°C and daily observation were taken up to the completion of experiment (ISTA,2010) .Field trial was done with seven treatments and their different combinations was grown in the field. Seeds were treated with bioagents and planted in RBD (Randomized Block Design) containing 90 seeds with three replications each containing thirty seeds. In the present study result both field and laboratory conditions shows that Bioagents Pseudomonas and Bacillus increase the growth of okra. To increase the growth of okra seeds we used different seed treatments of bioagents(Pseudomonas, Bacillus) at 12gm/Kg. We found that different treatments of bioagents increased germination and other growth parameters in okra seeds. Hence from the following study it can be concluded that these bioagents can boost the agriculture production without use of chemicals including pesticides insecticides and many more. Keywords- Biocontrol agents, okra, PGPR, sustainable agriculture.

MINIMIZING ALLELOPATHIC EFFECT OF *SOLANUM NIGRUM* BY USING BIOCONTROL AGENTS IN MUNG BEAN (*VIGNA RADIATA* (L.) WILCZEK)

MOHAMMAD SALMAN¹, DEEPTIPRABHA¹, SONY GRACE¹, J S CHAUHAN¹ AND GUFRAN AHMAD² 1DEPARTMENT OF SEED SCIENCE AND TECHNOLOGY. H.N.B. GARHWAL UNIVERSITY 2 DEPARTMENT OF MYCOLOGY AND PLANT PATHOLOGY, BHU VARANASI

The greengram, (*Vigna radiata* L.) (Wilczek) belongs to family Leguminaceae has been grown in India since ancient times. Allelopathy is defined as direct or indirect interaction, whereby chemicals and their breakdown metabolites released by one plants or organism influence the physiological process of another neighbouring plant. Allelopathy involves synthesising of various chemical compounds, known as allelochemicals, released to the environment. Allelopathic effect of *Solanum nigrum* has been studied earlier in some crops like onion. Allelopathic effect of leaf extract of *Solanum nigrum* was tested on the test crop *Vigna radiata* and compared with control and negative control. The effect of the extract was testedby observing Germination, Root length, Shoot length, Pod length, Dry weight, Fresh weight,Seedling length, Vigour index. The seed germination showed inhibitory and stimulatory influence on tested *Vigna radiata* plants. In bioagent treatments, all the parameters were significantly higher than the negative control. Seeds of green gram variety Virat were collected from Indian Institute of Pulses Research, Kanpur, Uttar Pradesh. Preparation and standardization of leaf extract of *Solanum*

nigrum was done and initially four concentration of *Solanum nigrum* extract 3%, 6%, 10% and 15% were used. From which 15% concentration of extract was effectively reducing germination and growth in a green gram so finally, 15% concentration was used for the further experiment. Aqueous extract was prepared by the leaves of *Solanum nigrum* which were dried in shade and then crushed in powdered form manually by using the mortar and pestle. 15% concentration of plant samples were made on the basis of weight and volume i.e. (45 gm. of plant material added in 300 ml of water). And extract was made. In the present study, we have found that *Solanum nigrum* shows the allelopathic effect on mungbean. According to the experiment, *Solanum nigrum* affected the germination of mungbean. To reduce the allelopathic effect of *Solanum nigrum* on germination of mungbean seeds we used different seed treatments of bioagents (*Pseudomonas, Bacillus*) at 6gm/Kg. From the result it can be concluded that mungbean seeds treated with bioagents reduce the allelopathic effect of *Solanum nigrum* and enhance the germination and all other parameters. **Keywords**: Allelopathic effect, *Solanum nigrum*, Vignaradiata, Bioagents, Vigour index.

HETEROSIS BREEDING EXPLOITING GYNOECY IN BITTER GOURD (MOMOREDICA CHARANTIA L.)

AHMAD ALHARIRI¹, T.K. BEHERA², GOGRAJ SINGH JAT² AND A. D. MUNSHI² ¹FACULTY OF AGRICULTURE, DAMASCUS UNIVERSITY, SYRIA P.O.BOX: 30621 ²DIVISION OF VEGETABLE SCIENCE, ICAR-INDIAN AGRICULTURAL RESEARCH INSTITUTE, NEW DELHI-110012

Eight parental lines including one gynoecious line PDMGy-201 (Gy-23) and their 28 F₁ hybrids obtained from half diallel analysis were used to estimate the extent of heterosis for earliness, yield and its contributing traits in bitter gourd. The gynoecious × monoecious hybrids were the most promising for earliness and yield traits. The best F₁ hybrid for earliness and desired sex ratio was PDMGy-201 × S-2 which recorded -32.58% heterosis for days to opening of first female flower over mid parent and -35.96% over standard parent. This hybrid also showed -23.65% heterosis for days to first picking over mid parent and - 28.24% over standard parent. Combinations with either gynoecious parent (PDMGy-201) or predominantly gynoecious (Pusa Aushadhi) showed maximum standard heterosis in negative direction for sex ratio, PDMGy-201 × PA (-99.07%), PDMGy-201 × S-2 (-96.81%) and S-54 × PA (-89.63%). The highest standard heterosis was observed in the hybrids S-32 × S-57 (47.62%) for fruit length, S-54 × S-57 (15.12%) for fruit diameter, S-54 × S-57 (29.07%) for flesh thickness. All the 28 F₁ crosses exhibited significant desirable heterosis for average fruit weight and yield per plant over mid and standard parent. The best performing F₁ hybrid PDMGy-201 × PV recorded 67.5% and 67.22% higher yield over mid and standard parent and 18.92% increase in number of fruits per plant over standard parent which may be exploited for commercial cultivation. **Key words:** Bitter gourd, Heterosis, Gynoecious, Earliness, Yield

CROP DIVERSIFICATION IN BANGLADESH: A VIABLE OPTION FOR FOOD AND INCOME SECURITY

SAYLA KHANDOKER¹, PRAVEEN K.V

ICAR-INDIAN AGRICULTURAL RESEARCH INSTITUTE, NEW DELHI, INDIA

¹PARENT INSTITUTION: BANGLADESH AGRICULTURAL RESEARCH INSTITUTE, GAZIPUR, BANGLADESH

Crop diversification has been used as an important strategy for increasing agricultural production and meeting the ever-changing demand of growing population in Bangladesh. The present study attempts to provide trends and extent of crop diversification, its drivers and determinants. The study is based on secondary data extracted from various sources like Bangladesh Bureau of Statistics (BBS), Bangladesh Economic Review (BER), Ministry of Agriculture (MoA) and FAOSTAT. Descriptive statistics and statistical methods are used in presenting results of the study. Hazel's decomposition method is used to find out the sources of growth. To discern the determinants of crop diversification at the division level, fixed effect model (FEM) and random effect model (REM) has been used. For best model selection between FEM and REM, Hausman specification test has been used. Area and production of major crops like rice, maize, potato and other horticultural crops have increased over the years due to technological advancement. Cropping intensity has been increasing since independence of the country. The value of Simpson Index of Diversification (SID) from 1998 to 2017 showed that Bangladesh agriculture is transforming from traditional subsistence agriculture to high-value agriculture although at a snail's pace. However, this transformation is not uniform across the regions/divisions. Average annual rainfall and gross irrigated area have a significant positive impact on crop diversification at division level. By developing market facilities, roads and infrastructure and making the irrigation system accessible for non-rice crops would enhance crop diversification which substantially helps the government to increase the potential of employment generation and earnings of the rural people in the country.

EFFECT OF YIELD AND YIELD ATTRIBUTES OF RICE UNDER DIFFERENT FERTILIZER MANAGEMENT PRACTICES GROWN UNDER SRI PRODUCTION IN KAVRE, MIDHILL OF NEPAL

M P NEUPANE

DEPARTMENT OF AGRONOMY, FACULTY OF AGRICULTURE, AGRICULTURE AND FORESTRY UNIVERSITY, CHITWAN – NEPAL

A field experiment was conducted during rainy season of 2016 to evaluate the effect of different fertilizer management practices on growth and productivity of rice grown under SRI system in Kavre district at farmers' field. The experiment was laid out in Randomized Completely Block Design involving seven different fertilizer management practices viz. Nutrient Expert Rice recommended chemical fertilizer (NPK), FYM (Farm Yard Manure), TP (Titepati), SOM (Shakti organic manure), GM (Goat manure), UD (Urine Drenching) and FFP (Farmers Fertilizer Practice) with four replications. The highest effective tiller m⁻² (210.8), panicle length (24.23 cm), number of filled grains panicle⁻¹ (81.37) grain yield (5.28 t ha⁻¹), straw yield (9.710 t ha⁻¹), and the lowest sterility (23.82%) were obtained from chemical fertilizer followed by Titepati, FYM, FFP, SOM, UD.

Key words: Growth, Productivity, SRI, Yield

Global Perspective in Agricultural and Applied Sciences for Food and Environmental Security (GAAFES-2019)

HETEROSIS BREEDING EXPLOITING GYNOECY IN BITTER GOURD (MOMOREDICA CHARANTIA L.) AHMAD ALHARIRI¹, T.K. BEHERA², GOGRAJ SINGH JAT² AND A. D. MUNSHI²

¹FACULTY OF AGRICULTURE, DAMASCUS UNIVERSITY, SYRIA P.O.BOX: 30621

²DIVISION OF VEGETABLE SCIENCE, ICAR-INDIAN AGRICULTURAL RESEARCH INSTITUTE, NEW DELHI-110012

Eight parental lines including one gynoecious line PDMGy-201 (Gy-23) and their 28 F₁ hybrids obtained from half diallel analysis were used to estimate the extent of heterosis for earliness, yield and its contributing traits in bitter gourd. The gynoecious × monoecious hybrids were the most promising for earliness and yield traits. The best F₁ hybrid for earliness and desired sex ratio was PDMGy-201 × S-2 which recorded -32.58% heterosis for days to opening of first female flower over mid parent and -35.96% over standard parent. This hybrid also showed -23.65% heterosis for days to first picking over mid parent and - 28.24% over standard parent. Combinations with either gynoecious parent (PDMGy-201) or predominantly gynoecious (Pusa Aushadhi) showed maximum standard heterosis in negative direction for sex ratio, PDMGy-201 × PA (-99.07%), PDMGy-201 × S-2 (-96.81%) and S-54 × PA (-89.63%). The highest standard heterosis was observed in the hybrids S-32 × S-57 (47.62%) for fruit length, S-54 × S-57 (15.12%) for fruit diameter, S-54 × S-57 (29.07%) for flesh thickness. All the 28 F₁ crosses exhibited significant desirable heterosis for average fruit weight and yield per plant over mid and standard parent. The best performing F₁ hybrid PDMGy-201 × PV recorded 67.5% and 67.22% higher yield over mid and standard parent and 18.92% increase in number of fruits per plant over standard parent which may be exploited for commercial cultivation. **Key words:** Bitter gourd, Heterosis, Gynoecious, Earliness, Yield

ENVIRONMENTAL LOSS-BENEFIT ANALYSIS OF HORTICULTURAL DYNAMICS IN KUMAUN HIMALAYA, UTTARAKHAND

P.C. CHANYAL, SAURBH CHAMOLI AND MISS DIVYA SHIVANI

DEPARTMENT OF GEOGRAPHY, D.S.B. CAMPUS, KUMAUN UNIVERSITY, NAINITAL

The entire region of Kumaun has favorable nature-agro-climatic conditions as such it can generate income, foreign exchange along with generating self-employment from horticultural cultivation throughout the year. The horticultural farming is practiced in this region since the British period. Chaubatiya garden in Ranikhet and Ramgarh lies under the Lesser Himalaya, the regions which are famous especially for producing apples and oranges, but presently they mainly produce vegetables, fruits, flowers, aromatic plants. Kumaun Himalayan region has gradually increased the area and production of fruit crops. According to a report of Uttarakhand Agriculture Department, Kumaun Division with six districts is having about 40991.73 hectares under the fruit crops cultivation of the total reported land of 2010834 hectares according to the data of 2003-04. By 2010-2011 the cultivated area under the fruit crops increased to 86403 hectares. Similarly, the production of fruit crops is also increased after 2003. However, due to the initiatives taken by and policies of Uttarakhand Government, the State having grown up in the field of development of horticultural sector after its separation from U.P. in the year 2000. Kumaun had produced about 320218.06 MT of fruit crops during the year 2003, which increased to 394909.00 MT by 2010 with a per hectare yield of 4.57 MT. Since the British period, farming culture was completely organic. After independence there has been tremendous increase in production and control of several plant and fruit diseases by the use of pesticides, fertilizers, hybrid seeds etc. but on the other side due to application of advance technologies and recent trends of farming it has resulted in significant negative impact on environment and the entire ecosystem. The present study is conducted to assess and evaluate impacts of horticulture development on soil, ecosystem, water, human health and socio-economic condition along with describing the influence of the horticultural farming in the study area of research. Environmental quality index and range of methods have been employed to study the impact assessment on the environment. Researcher has taken two development block as sample units for assessing the losses and benefits on environment of Horticultural development in Kumaun Himalaya, which is the case study intensively. Hence, scaling weight checklist method has been adopted under these parameters viz., Soil resources, Flora and Fauna, Water resources, Human Health and Socio-economic factors. The significance of the research is that entire natural resources of Himalayan regions are contaminating and degraded rapidly in last two decades, so too aware about research results and to assess the status of environmental quality in hilly area.

Keywords: EQI, Environmental Loss-Benefit, Kumaun Himalaya, Food Security

CROPPING DIVERSITY AND DIVERSITY OF FOOD OF WOMEN INFLUENCES THE CHILD MALNUTRITION ON FLOOD AFFECTED REGION OF SIRAHA DISTRICT, NEPAL SANTOSH MARAHATTA

DEPARTMENT OF AGRONOMY, AGRICULTURE AND FORESTRY UNIVERSITY (AFU), RAMPUR, CHITWAN, NEPAL

Terai region is famous as the grain basket of Nepal, characterized as the high population density and increasing urbanization in the recent days. The flash flooding incurs great losses to the agriculture livelihood then influence the nutrition of the poor farm families. This problem is severe especially in the eastern Terai of Nepal due to fragile environment, young geology, monsoon climate and low to socioeconomic adaptation capability against the climate change. A survey study was done with mixed methods using both qualitative and quantitative approaches, to assess knowledge, attitude, and practices on nutrition and agriculture-based livelihoods of three municipalities of Siraha district, namely Siraha, Kalyanpur and Karjanha, all are situated in the eastern bank of Kamala River. The quantitative method included a purposive and random sampling of 496 households from each wards of these municipalities which are adjacent of Kamala River (five wards from Siraha, six wards from Kalyanpur and five wards from Karjanha) and only five wards from the other remaining. In ward level, marginalized, disadvantaged and flood-affected communities were purposively selected. Within the communities, households were purposively (household with child of <5 years) and randomly selected. The sample size was obtained using the sample size calculation formula given by Daniel (1999) for the known population. The household survey was conducted using the IT-based application with AKVO Flow software using Tab. For the study of the malnutrition status of child 1299 children were selected randomly from the all selected wards. While the qualitative survey included focus group discussion (FGD), key informant survey, in-depth study of some farmers and direct field observation with the help of checklists. Only 62.29% of the households have their own land for agricultural production. Rice, wheat, maize, and lentil are major field crops grown. Around one third of the households are engaged in vegetable production. Potato, onion, brinjal, tomato, and garlic are major vegetables. Milk, yogurt and ghee are the major livestock product. Based five food diversity (cereals, pulses, vegetables, oilseeds, and eggs/meat), 0.2% household grown/rare/used five food groups on own household, 3.02% have four food groups, 11.49% have three food group, 19.56% have two food group. Nearly 61 for women of reproductive age and around 79%

for the mother of children aged 0-59 months fulfill the minimum diet diversity. More than half (56%) of the surveyed mothers were aware with examining the child nutrition status. A large number of mother (75.41%) fed their baby with breast milk that day before, more than the half of the mother fed porridge, bread, rice, noodles or other foods made from grains, potatoes, white yams or any other foods made from roots that day before. Around 50% of the children of the study area are suffering from the malnutrition. The severe acute malnutrition (SAM) and moderately acute malnutrition (MAM) is 31.3% and 28.6% respectively. A greater part of the respondents (83%) felt good about exclusively breastfeeding for six months. Finally intensification of land use and diversification of crops should be focused for improving the food and nutritional security.

CLIMATE SMART AGRICULTURE: EXPERIENCES FROM NEPAL SUNITA GHIMIRE

AGRICULTURE AND FORESTRY UNIVERSITY (AFU), RAMPUR, CHITWAN

Nepal has an extremely varied and complex climate, driven by the contrasting terrain and regional weather systems. Within a short territory, drives strong temperature gradients across the country. Nepal's agricultural sector, main source of national economy and livelihood, is strongly affected by current climate variability, uncertainty and extreme events. Although Nepal is responsible for the lowest emitters in the world but vulnerable country and the impacts are being felt. Rise in in temperature, shifting in the rainfall pattern, frequent extreme weather caused the serious impacts to poor and vulnerable households including women, and may pose a challenge to food security. Farming communities are already undertaking several local coping strategies. Most of the modern agricultural technologies that have been promoted were imported from the West, where they were developed for large holders agricultural systems, which really does not benefits the small farmers in Nepal, where labour is cheap and capital is expensive. But during these days climate smart agriculture technologies range from a simple adjustment in crop management practices to the transformation of agricultural production systems to adjust to new climatic conditions in a particular location. These include, depending on their appropriateness for a particular location, watersmart practices, weather-smart activities, nutrient-smart practices, carbon- and energy-smart practices and knowledge-smart activities. Many of these interventions have been successful in raising production and income, and building the resilience of farming communities in many locations in Nepal. Thus the dissemination of the appropriate technologies in our context for targeting the poor and marginal farmers that promote agricultural or post-harvest productivity; generate cash income through either cash crops or other means of income generation; focus on dry land farming. A major challenge is to simplify these technology for wider scale dissemination and adaptation to the farming communities without losing components that are crucial to its success.

EFFECT OF LIGHT ANNUAL PRUNING, PACLOBUTRAZOL AND POTASSIUM NITRATE ON YIELD AND QUALITY CHARACTERS IN MANGO CV. LANGRA

ABHAY MANKAR¹, K. KARUNA², V. B. PATEL AND AMIT RAJ² ¹DIRECTORATE OF EXTENSION EDUCATION, B. A. U., SABOUR, BHAGALPUR, BIHAR, INDIA ²DEPARTMENT OF HORTICULTURE (FRUIT & FRUIT TECH.) B. A. C., SABOUR, BHAGALPUR, BIHAR ³ DIVISION OF HORTICULTURE, IARI, NEW DELHI, INDIA

Mango is a leading fruit crop in India, belongs to the family Anacardiaceae. It is popularly grown in both tropical and sub-tropical climate. There are many hindrances for low productivity in old mango orchard. Out of different problems of low productivity one of them is flush pattern as well as less number of flushes emerged. Keeping these facts in mind this experiment was conducted on 30 years old mango plants to improve the number of current season flushes on which flowering buds emerged. The trial was laid out with three pruning level of terminal shoot ($S_0 - No$ pruning, $S_1 - 25$ cm and $S_2 - 50$ cm), paclobutrazol level (P_0 - No PBZ and P_1 - 3.0g a.i/plant/sq.m) and potassium nitrate level (N_0 - No KNO₃ and $N_1 - 3\%$ KNO₃) in twelve treatment combinations with three replications in factorial RBD. Total soluble solids (TSS) and total sugar were found non - significant in all treatment combination. Other quality parameters like titrable acidity, reducing sugar and ascorbic acid were reported significant. In respect of reducing sugar the main effect of pruning, potassium nitrate and interaction effect of pruning x paclobutrazol and paclobutrazol combination. In paclobutrazol and potassium nitrate highest reducing sugar (4.03 %) whereas lowest (3.00 %) was found in pruning x paclobutrazol combination. In paclobutrazol and potassium nitrate highest reducing sugar (3.95 %) whereas lowest (3.16 %). There was no effect of potassium nitrate and interaction of pruning and paclobutrazol on titrable acidity whereas other main effect and interaction effects were significant. Almost similar results were found in ascorbic acid content. Above results may be concluded that proper ventilation inside the canopy through light annual pruning and use of chemicals makes the plant healthy in respect of yield and quality.

CLIMATE CHANGE AND INFORMATION NEEDS OF APPLE GROWERS IN KUMAON REGION OF UTTARAKHAND

MOHMMAD ASLAM ANSARI AND JAGJEEVAN BARAKOTI

DEPARTMENT OF AGRICULTURE COMMUNICATION, COLLEGE OF AGRICULTURE, G. B. PANT UNIVERSITY OF AGRICULTURE & TECHNOLOGY, PANTNAGAR (UTTARAKHAND).

Uttarakhand along with Jammu & Kashmir and Himanchal Pradesh is widely known for its juicy and delicious apples. However, due to climate change and its adverse impact, the area and production under apple crop is rapidly declining as farmers are not able to cope-up with climate change and variability; and switching to other crops for their livelihood. In view of this, the present study was undertaken to find out the information needs of apple growers about climate change and the constraints faced by them. The study was conducted in one purposively selected district (Nainital) of Kumaon region of Uttarakhand as it has maximum area under apple cultivation besides having highest production. The study sample comprised of 120 apple growers spread across the four villages; and the data was collected using pre-tested structured interview schedule. A composite 'Climate change Information Needs index' was developed to ascertain the information needs of apple growers. The findings indicted that majority apple growers (70%) expressed 'medium' information needs along with 12.5% percent with high information needs about climate change and its impact on apple cultivation. Further, they also wanted to get information about various climate parameters, cropping practices, and relevant/ appropriate adaptation strategies for mitigating climate change impact. Further, as regards constraints faced by apple growers, majority of them told that 'they were not aware of the sources of information about

climate change' followed by ' how to access internet to get information about climate change', and 'affordability of searching information on the net', and 'lack of support from public extension system'. The study has implications for extension scientists, policy makers and the entire public extension system in planning and implementing strategic interventions for meeting the climate change information needs of apple growers and help in mitigating the adverse impact of climate change on horticulture crops in hilly regions of Uttarakhand, and also elsewhere in mountainous ecosystems in India and the world.

Key Words: Climate Change, Information Needs, Apple growers, Hiil Agriculture, Adaptation strategies.

THE IMPACT OF MAHATMA GANDHI NREGS IN DISTRICT BAGESHWAR

MAHESH KUMAR

REGISTRAR KUMAUN UNIVERSITY, NAINITAL.

Mahatma Gandhi NREGS is the most ambitious employment programme in human history in India. It will not be an exaggeration to say it a mother of all rural development programmes if the certain points with regards to its implementation like Transparency, its participatory approach, accountability, strict vigilance and monitoring etc are taken into consideration.

The present study was undertaken to comprehend and evaluate the impact of Mahatma Gandhi NREGS in district Bageshwar. The increasing trend was noticed in terms of Average no of employment provided to registered families in a year, Total no. of man days generated, No. of families provided 100 days of employment, No. of works taken up, Share of women, Reduction in Migration, Financial Inclusion of poors, Asset Creation etc. In future it is going to be a milestone in poverty alleviation as presently 100 days of guaranteed wage employment is being provided. In future it is possible to make it for more than 100 days as demanded by many workers, if the programme is implemented successfully. Mahatma Gandhi NREGS is a very ambitious scheme of its kind in India. In District Bageshwar, the scheme was found very effective in increasing wage employment, quality asset creation, total manday generation, reduction in migration, financial inclusion and women participation etc. Although certain hurdles were seen to be faced by workers like delay in wage payments, shortage of MGNREGA staff etc. It the limitations are taken care, the programme will not only prove effective in employment generation but also in natural resource management.

Key Word- Mahatma Gandhi NREGS, Employment, Wages

HYDROPONICS AS AN ADVANCED TECHNIQUE FOR VEGETABLE PRODUCTION: CHALLENGES AND POSSIBILITIES

*RAJ KUMAR JAKHAR AND SANTOSH SHIVRAN

*DEPARTMENT OF HORTICULTURE, INSTITUTE OF AGRICULTURAL SCIENCES, BANARAS HINDU UNIVERSITY, VARANASI- 221005 (U.P.), INDIA

DEPARTMENT OF GENETICS AND PLANT BREEDING, JAWAHARLAL NEHRU KRISHI VISHWA VIDYALAYA, JABALPUR- 482004 (M.P.), INDIA

The term hydroponics was derived from Greek word "hydro" means water and "ponos" means labor. This system is most effective to help face challenges of climate changes and also helps in production of crops and vegetable which is 100% safer to eat. For hydroponics technology, no soil is required to grow some selected demanded crops. It is also termed as (soil less culture) technique where crops are grown in liquid based nutrient rich solutions under green house. As it is well known hydroponics does not require any soil, where root system is supported using inert medium such as clay pellets, pertile, gravels etc. For the farmers those have less fragmented land can perform hydroponic culture in greenhouse to increase crop productivity. In cases of crop loss by natural disaster, they must have another option of farming to survive and grow organic, pesticides free vegetables which would further enhance economic growth of our country. **Keywords:** Hydroponics, Soil less culture, Crop productivity.

VARIABILITY IN BIOACTIVE PROPERTIES OF CHERRY TOMATO CULTIVARS AND IMPACT OF DIFFERENT GROWING STRUCTURES ON TECHNOLOGICAL PARAMETERS OF NAGMOTI CULTIVAR

PANKAJ KUMAR KANNAUJIA¹, SAKHARAM KALE¹, RAMESH KUMAR¹ AND R.K. SINGH¹

¹ICAR-CENTRAL INSTITUTE OF POST-HARVEST ENGINEERING & TECHNOLOGY, PUNJAB, INDIA

In this presented study, six commercial cherry tomato cultivars fruits were harvested at red ripe stage and analyzed for variations in total antioxidant activity, total phenolics, total carotenoids, lycopene content, ascorbic acid, respiration rate, titratable acidity, dry matter content and total soluble solids. Among the different cherry tomato cultivars, significant differences were observed with respect to different physical, physiological and functional quality parameters. About 2.48-fold variation in titratable acidity, 2.47-fold variation in total phenolics, 4.13-fold variation in total carotenoid and 7.68-fold variation in lycopene content were recorded among the different cultivars. The total antioxidant activity and respiration rate were also found to vary about 1.85-fold and 1.48- fold respectively. The highest antioxidant activity, as well as total phenolic content, was found highest in the Cherry Tomato Hybrid no.1 followed by Pusa Cherry Tomato-1 cultivars. In the case of dry matter, the differences among the different cultivars were 1.40-fold. Hierarchical cluster analysis classified the cherry tomato cultivars into three groups based on health-promoting bioactive compounds. Besides this study Nagmoti cultivar was also evaluated for variation in different technological parameters grown under different protected cultivation structures. Results showed that highest total antioxidants activity (15.45 µmol trolox equiv. g⁻¹) was found in insect-proof net house and total phenolics (689.00 μg GAE g⁻¹) was highest in shade net grown cherry tomatoes. However; highest total carotenoids (13.21 mg/100g), lycopene content (9.37 mg/100g) and ascorbic acid (20.88 mg/100g) were found in walking tunnel followed by shade net house grown cherry tomato. Among the evaluated cultivars; Cherry Tomato Hybrid no.1, Pusa Cherry Tomato-1 and Nagmoti were found to be rich in bioactive compounds and exhibited higher functional quality than other cultivars. In case of different growing protected structures walking tunnel followed by shade net proved best compared to openly grown cherry tomato.

Keywords: Antioxidant activity, bioactive properties, cherry tomato

CORAL REEFS AND CLIMATE CHANGE

RENU SHARMA

DEPARTMENT OF BOTANY, G.D.H.G. COLLEGE, MORADABAD

Oceans cover two thirds of the Earth's surface. They are responsible for almost 70% of the oxygen that we get and act as massive sinks for the greenhouse gases emitted by anthropogenic activities. One of the most unique features of the oceans are coral reefs. Coral reefs support some of the most biodiverse ecosystems on the planet. Millions of people rely on coral reefs for essential nutrition, livelihoods, protection from life-threatening storms and crucial economic opportunities. Coral reefs only occupy 0.1% of the area of the ocean but they support 25% of all marine species on the plane, hence are called rainforests of the sea. About half the world's shallow water coral reefs are already gone and continue to disappear, one of the reasons being **coral bleaching** which occurs when coral polyps expel algae that live inside their tissues, causing them to turn completely white. Most of them eventually starve to death. Without urgent action to address climate change, pollution, overfishing and destructive coastal development, they could all but disappear. One of the biggest threats to coral reefs is posed by climate change. Since 1955, 90% of the atmosphere's excess heat is absorbed by oceans. The most recent event which was the longest and most widespread bleaching event ever recorded, killing as much as two-thirds of the corals in the northern part of Australia's Great Barrier Reef. If the oceans get warmer with the same rate as of today, it is estimated that all corals may disappear by 2050. The aim of this paper is to shed light on coral reefs, their importance and how our activities are responsible for the degradation of yet another ecosystem.

RESPONSE OF NUTRIENTS ON PHYSICAL AND BIOCHEMICAL CHARACTERS OF FRUITS IN KINNOW MANDARIN (CITRUS RETICULATA BLANCO)

KUMARI KARUNA^{1,*}, ABHAY MANKAR², RAJNI SINHA¹ AND PAWAN KUMAR¹ ¹DEPARTMENT OF HORTICULTURE (FRUIT & FRUIT TECH.),BIHAR AGRICULTURAL COLLEGE, SABOUR, BIHAR, INDIA

²DIRECTORATE OF EXTENSION EDUCATION, BIHAR AGRICULTURAL UNIVERSITY, SABOUR, BIHAR, INDIA

This experiment was conducted at Bihar Agricultural University, Sabour to show the feasibility of Kinnow mandarin under Bihar condition. The fertigation trials were carried out in three consecutive years i.e 2014, 2015 and 2016. The experiments were laid out with seven fertilizer levels viz 120 % RDF, 100 % RDF, 80 % RDF, 60 % RDF, 40 % RDF, 100 % RDF in basal with drip irrigation and 100 % RDF in basal without drip irrigation with three replications in randomized block design. The trial was conducted during three consecutive years i.e, 2013-14, 2014-15, 2015-16 to show the effect of fertigation on physical and biochemical characters of fruits in Kinnow mandarin under high density planting. Result of three years pooled data on physical parameters showed that increase in fruit weight (177.0 g), length (64.29 mm), width (73.36 mm), and yield (16.93Kg/plant) were higher under higher doses of fertigation i.e 120 % RDF followed by 100 % RDF. Biochemical characters like total soluble solid (9.78 °Brix), minimum titrable acidity (0.83 per cent), TSS : acid (11.76), ascorbic acid (46.50 mg/100g juice) and reducing sugar (3.75 per cent) were also recorded higher under higher doses of fertigation. However, all essential nutrients (macro & micro) influence low yield which may improve by the application of balanced dose of fertilizer in split doses through fertigation.

Key words: Kinnow, fertigation, physical, biochemical characters

SEED PLANT TAXA RICHNESS ALONG ELEVATION GRADIENT IN UTTARAKHAND, INDIA

D.S. RAWAT & SUMANT TARAFDAR

DEPARTMENT OF BIOLOGICAL SCIENCES, CBSH, G.B. PANT UNIVERSITY OF AGRICULTURE & TECHNOLOGY, PANTNAGAR 263 145, UTTARAKHAND, INDIA

Species richness of seed plants is known to change along elevation gradient in the mountains and the Himalaya is no exception to this. Uttarakhand Himalaya represents one of the highest elevation gradients in the world with vertical stretch of more than 7600m. Rich wild seed plant diversity of more than 4500 species presents an excellent opportunity to study taxonomic pattern of taxa (species, genera, families, orders) richness along changing elevations. Elevation ranges of 3,144 wild species of seed plants, belonging to 1,140 genera, 169 families, 51 order and 3 subclasses were compiled from authentic published sources and the three decade long field experiences. Richness patterns of species, genera, families, and orders along elevation gradients were prepared based on the compiled elevation ranges of species. Nearly all richness patterns, irrespective of taxa ranks, are with low to mid elevation peaks showing the hump shaped pattern except the Malvales, Fabales, Malpighiales, Fabaceae, Malvaceae, Indigofera and Euphorbia. These exceptional taxa have preponderance of tropical elements leading to monotonic decline of species richness with increasing elevation. Maximum richness of species was found at 2400-2700 m elevation zone with 38.26% (1,203) species, genera at 900-1200 m elevation zone with 55.08% (628) genera, families at 1200-1500 m with 81.65% (138) families, and orders at 1200-1800 m with 92.15% (47) orders. The species richness of Gymnosperms was found different from Angiosperms and peaked at the elevation zone 2700-3600 m involving 93.33% (14) species. The rates of reduction of taxa (species, genera, families, and orders) along increasing elevation were also calculated. The overall rates of reductions of different taxonomic ranks are almost linear with 1.66% species/100 m (52.31 species/100 m), 1.68% genera/100 m (19.91 genera/100 m), 1.73% families/100 m (2.92 families/100 m), 1.63% orders/100 m (0.83 order/100 m) between 300-6300m. The rate of reduction of taxa ranges between 1.63 - 1.73 % /100 m irrespective of the taxonomic ranks. The average rate of reduction of species richness for world mountains (40 spp./100m), European mountains (15-45 spp./100m) and high altitudes of Garhwal Himalaya (24 spp./100m) are considerably lower than the rates obtained in presented study and could be attributed to higher species richness in the study area. Key Words: Elevation gradient, Himalaya, taxa richness, species, genera, family, order

REVIEW ON SOLID WASTE MANAGEMENT OF MANGO IN AN ECONOMICAL WAY

ABHA YADAV¹, SANGAM ADHIKARI, DR. ANKEET KUMAR

DEPARTMENT OF AGRICULTURE AND FORESTRY, TULA'S INSTITUTE, DEHRADUN

Mango is considered as one of the most important tropical fruit, with overall production of 42 million tons, worldwide. It belongs to the genus *Mangifera* and Family *Anacardiaceae*. After its Consumption or industrial processing, by product such as peel, kernel and seed coat are discarded as waste materials. Utilization of byproduct can be economical way to reduce waste disposal pollution. Up to the latest research and experiments the peel and seed kernels are used in different forms such as peel powder, kernel flour, and kernel oil which are found to be with a high nutritional value. Carbohydrate (69.77%), Fat (11.5%), protein (7.53%), potassium (3.68%), crude fiber (2.20%), magnesium (2.1%), calcium (1.7%), Iron (0.12%) (may vary according to variety and different environmental factor) and may other essential nutrients. Beside this mango peel are also rich in polyphenols, carotenoids and vitamins. Kernel oil contains 44-48% of saturated fatty acid (Majority stearic acid) and 52-56% of unsaturated fatty acids. They are widely used also because of their natural antioxidant and antimicrobial properties. Scientists have also found that mango peel was able to remove the heavy metals of Cadmium (Cd) and lead (Pb) from aqueous solution because of their bisorbent properties. Mango kernel oil can be used as alternative of synthetic antioxidants for the preservation of fats and oils, used as alternative of cocoa butter, used in confectionaries and to solve many nutritional health issues. Similarly, several value products can be developed from different combination of mango kernel flour with other flour. Hence, carrying on the innovative approach of processing mango solid waste is effective to minimize the pollution leading to healthy environment with income generation.

Keywords: Mango seed kernel, kernel flour, kernel oil, bisorbent

CAN INDIA AFFORD ANY MORE FOOD LOSSES?

ANIKETA HORO¹, TANUREET KAUR² AND KHUSBOO RAJ³

¹DEPARTMENT OF ECONOMICS AND SOCIOLOGY, PUNJAB AGRICULTURAL UNIVERSITY, LUDHIANA-141004 ²DEPARTMENT OF FOOD SCIENCE AND TECHNOLOGY, PUNJAB AGRICULTURAL UNIVERSITY, LUDHIANA- 141004 ³DAIRY EXTENSION DIVISION, ICAR- NATIONAL DAIRY RESEARCH INSTITUTE, KARNAL-132001

India's declining rank in the Global Hunger Index (GHI) with the passage of time contradicts the very purpose of the implementation of the National Food Security Act (NFSA) in 2013. The total food grain production of India is estimated to be 281.37 million tonnes in 2018-19 and the total stock maintained by the Food Corporation of India was 467.27 lakh tonnes till this February. This shows that India has a surplus in foodgrain production, so where does the problem lie? Production of foodgrain is one aspect while the actual consumption of foodgrain is another aspect of ensuring food and nutritional security. According to the report of Welthungerhilfe and Concern Worldwide, India is amongst the 45 countries that have "serious levels of hunger". About 68% of under-5 mortality in India is still due to malnutrition i.e. two out of three child deaths in our country is due to malnutrition and the states of Assam, Bihar, Rajasthan, Uttar Pradesh top the malnourished charts in India. On the backdrop of this burning issue of hunger and malnutrition, this review paper tries to identify the sources of food loss and its possible solutions.

Keywords: Food loss, hunger, malnutrition

POST HARVEST MANAGEMENT OF FRESH-CUT CUCUMBER THROUGH THE COMBINED EFFECT OF CHITOSAN COATING AND MODIFIED ATMOSPHERE PACKAGING

MANJU NETWAL^{1*}, RAJ KUMAR JAKHAR², PRAVEEN CHOYAL³, GULAB CHOUDHARY⁴, SEEMA YADAV⁵ ^{1*,3,4,5}DEPARTMENT OF HORTICULTURE, SKNAU, JOBNER- 303329 (RAJASTHAN). ²DEPARTMENT OF HORTICULTURE, INSTITUTE OF AGRICULTURAL SCIENCES, BANARAS HINDU UNIVERSITY, VARANASI- 221005 (U.P.), INDIA

Coated with different concentrations of edible chitosan solutions and packaged in air-, nitrogen-, and argon-based MA to preserve quality and extend shelf life of fresh-cut cucumber. The effectiveness of individual and combined treatments on some quality parameters was examined at intervals during 12 days storage at a temperature of 5°C. The concentration of chitosan solutions significantly affected the performance of fresh-cut cucumber in MA packages. Improved quality retention and reduced carbon dioxide production were observed in chitosan-coated fresh-cut samples. Argon-based MA packaged samples exhibited better potential than air and nitrogen-based MA packaging in retarding tissue respiration, physiological changes, chlorophyll degradation, and extending shelf life of fresh-cut cucumber. Combined chitosan coating with MA packaging maintained quality, microbial safety, and extended the shelf life of fresh-cut cucumber. The combination of chitosan coating with argon-based MA packaging best preserved quality and prolonged the shelf-life of fresh-cut cucumber throughout 12 days storage. The synergy between chitosan treatment and argon-based MA packaing has potential application in the food industry to preserve the overall quality and extend the shelf-life of the fresh-cut cucumber.

FOOD PROCESSING INDUSTRY IN INDIA: STATUS, SCOPE, AND CHALLENGES

ANIKETA HORO¹, YOGITA SHARMA¹, JEEVITHA G.N.¹, AND TANUREET KAUR²

¹DEPARTMENT OF ECONOMICS AND SOCIOLOGY, PUNJAB AGRICULTURAL UNIVERSITY, LUDHIANA

²DEPARTMENT OF FOOD SCIENCE AND TECHNOLOGY, PUNJAB AGRICULTURAL UNIVERSITY, LUDHIANA

With the increasing food losses and unfruitful attempts of India to tackle hunger and malnutrition, it becomes necessary to find solutions for these issues. One such avenue is the processing of food since its market is expected to grow to \$543 billion by 2020 against \$322 billion in 2016 (CAGR of 14.6%). The food processing sector is fully capable of addressing critical issues like food security, food inflation and nutritional security to the masses. Increased agricultural production, availability of raw materials, an increase in demand for processed food products and government incentives have positively affected the food processing sector. The Annual Survey of Industries (2014-15) has revealed that most of the industries in food processing are MSME with average fixed capital per registered factory of Rs. 4.97 crores. There

are around 38,608 registered food processing factories which together contribute 10.88% to the GVA. Even the unregistered food processing sector provides 47.9 lakh employment i.e. 13.72% of the employment in the unregistered manufacturing sector (NSSO 67th Round). The major blooming reasons for the processing industry in India may be attributed to the increasing urbanization, change in lifestyle and food habits, and increasing number of nuclear families with working women. While the major challenges faced by the industries may include lack of infrastructure, inadequate focus on food safety and quality standards, lack of product development and innovative research and development in this area. This review paper tries to analyse the status, scope and challenges for processing of cereals, fruits & vegetables, dairy and meat in India.

Keywords: Food processing, India.

EFFECT OF DIFFERENT CHEMICALS ON SEED YIELD AND OUALITY TRAITS IN WHEAT (TRTICUM AESTIVUM L.).

V. K.CHOUDHARY*, RAVI KANT¹, RAJESH KUMAR², U.K..SINGH³, S.BHUSHAN⁴ AND A.K. CHOUDHARY⁵ DIRECTORATE OF SEED & FARMS, DHOLI, MUZAFFARPUR-843121(BIHAR) 1,2,3 RPCAU, PUSA, SAMASTIPUR, BIHAR ^{4,5}BAU,SABOUR,BHAGALPUR

An experiment was conducted at TCA, Dholi farm under RPCAU, Pusa during Rabi 2017-18 in normal and late sown irrigated conditions in split plot design with three replications following good cultural practices with an objective to know the effect of spraying of different chemicals in mitigating the effect of elevated temperatures on seed yield and quality traits in wheat variety HD-2733. Result showed that out of six treatments, T1 & T2 (Glycine betaine & Salicylic acid respectively) significantly influenced 1000- seed weight, seed yield /plant and vigour index. Among date of sowing, significant effect was observed for normal date of sowing in all the characters except germination percentage. Among interaction effects, no significant contribution was recorded for any chemical treatment combinations. Spraying of Glycine betaine (600 ppm) and Salicylic acid (800 ppm) reduced the effect of high temperature resulted in average yield of wheat even in late sown condition.

Key Words: Chemical, elevated temperature, late sown, wheat.

DIVERSITY OF POLLINATORS AND POLLINATION EFFICIENCY OF INDIAN HONEY BEE IN BROCCOLI, BRASSICA OLERACEA VAR ITALICA L.

SUNAULLAH BHAT¹, JOHNSON. STANLEY ², JAI PRAKASH GUPTA³, A.R.N.S. SUBBANNA⁴, SANDEEP KUMAR⁵ ^{1, 5,} DEPTT. OF ZOOLOGY, KU SSJ CAMPUS, ALMORA, UTTARAKHAND, INDIA

^{2, 3, 4,} ICAR- VIVEKANANDA PARVATIYA KRISHI ANUSANDHAN SANSTHAN

Broccoli, Brassica oleracea var italica L. is an important edible vegetable crop. Though the flowers have both male and female parts in close proximity, the sporophytic self-incompatibility necessitates pollinating vectors for proper seed set. Hymenopterans were reported to be dominant pollinators of broccoli. A study was conducted at ICAR-Vivekananda Parvatiya Krishi Anusandhan Sansthan, Experimental form Hawalbagh during March- April 2019 to assess the diversity of pollinators and efficiency of Indian honey bee, Apis cerana in pollinating broccoli. Indian honey bee was found to be predominant pollinator followed by Italian honey bee. Broccoli also attracts non-Apis bees like small carpenter bees, digger bees, leafcutter bees, bumble bees and carpenter bees. Pollination behavior in terms of peak activity, flowers handled per unit time, time spent per flower and time spent in flower searching were studied separately for both pollen and nectar foragers. Indian bees recruited more pollen foragers than nectar foragers. The peak visitation of both pollen and nectar foragers was found at 13 hours. Pollination efficiency of A. cerana in broccoli, was measured by means of seed set by flowers had unrestricted pollinator visitations, flowers had single Indian honey bee visit and flowers excluded from pollinator visit. The pollination efficiency of Indian bee was found to be 0.54 and the visits required for optimum seed set was 1.84 per flower. Key words: Broccoli, Diversity, Pollinators, Indian honey bee, pollination efficiency

SOIL ORGANIC CARBON AS A STRATEGY TO MITIGATE CLIMATE CHANGE IN SUB TROPICAL SAL FOREST,

CENTRAL HIMALAYA, INDIA.

RACHITA PANDEY, SURENDRA SINGH BARGALI AND KIRAN BARGALI

DEPARTMENT OF BOTANY, DSB CAMPUS, KUMAUN UNIVERSITY, NAINITAL, UTTARAKHAND, INDIA.

Soil organic carbon (SOC) is a vital component of global carbon cycle which serves as a building block for the soil structure, and the changes in its accumulation and decomposition directly influence terrestrial ecosystem carbon storage and global carbon balance. The present study was carried out to determine the contribution of SOC in mitigating atmospheric CO₂ in sub tropical sal forests. To catalogue the variations among the SOC content, four sites (within an elevational range of 405 m to 683 m) were selected in the bhabhar region of Nainital district, Uttarakhand, India. Soil samples were extracted up-to a depth of 60 cm (0-20, 20-40 and 40-60 cm) seasonally for one year. The results for the soil texture revealed that all the sites have different soil types i.e. Site I (Silty loam), Site II (Silty clay), Site III (Silty clay loam), Site IV (Clay loam). The bulk density (bD) increased with increasing soil depth and the value ranged between 1.25 and 1.33 gcm⁻³ for all the sites whereas porosity showed reverse trend and decreased with increasing soil depth. Across the sites maximum SOC was observed for site IV (2.74 %) followed by Site I (1.78%), Site III (1.45%) and Site II (1.30%), respectively. Rainy season yielded maximum SOC content (1.85%) followed by winter (1.83%) and summer season (1.78%). Maximum SOC content was observed in the uppermost organo-minerallic soil layer (0-20cm) i.e. 1.89% and SOC declines considerably along increasing soil depth with minimum value in the deepest soil depth (1.73%). The results obtained for soil CO_2 mitigation along all the sites, depth and seasons were in accordance with the results obtained for SOC i.e. site IV mitigated maximum CO₂ (251.35 t C ha⁻¹) followed by Site I (173.29 t C ha⁻¹). Site III (140.65 t C ha⁻¹) and Site II (124.85 t C ha⁻¹), respectively. The results of the study revealed SOC storage and the dynamics of C stock change in forest soil across the seasons which will be important in evaluating the impact of forest soil management on global climate change.

Key words: Soil organic carbon (SOC), Soil CO₂ mitigation, Soil management, Global climate change.

ENVIRONMENTAL INSECURITY EXISTING AMONG NOMADIC TRIBES

DEEKSHA NAIK¹, KASTURIBA B.² AND USHA MALAGI³

1,2,3. DEPARTMENT OF FOOD SCIENCE AND NUTRITION

Nomads are a group of communities who travel from place to place for their livelihood. They do not have a fix settlement. These nomadic tribes travel from one place to another place and wherever they find waste land, they put up their tents and live there for a few months and next they move on to another place. Most of the times their physical environment will not be good, they live nearby waste disposal pit or either side of roads, far from all the facilities including health, water facility etc. These factors influence the health status of the population. Specifically vulnerable groups namely women, adolescent girls and children are most affected. Sample size of 30 families from 6 districts of North Karnataka were selected by purposive sampling technique. General information regarding socio-demographic was collected by pretested structured questionnaire. Information about type of house, water source, animals government facilities available, ease of transport from one place to the other etc was collected. Majority of them were migrants from Rajasthan. Excreta disposal was open. They resided in tents. Overall socio-demographic characteristics of these tribes were found to be very poor. The type of environment in which these families reside is not fit for humans to live. They have no security. Quality of life of these families are very poor. Measures are to be taken for upliftment of these tribes, so that they can also lead a decent life.

Keywords- Nomads, Quality of Life, North Karnataka

NUTRITIONAL BREEDING OF VEGETABLE CROPS

SHASHIKANT THAKUR¹, ABHILASH SINGH²

¹DEPARTMENT OF HORTICULTURE, NATIONAL P.G. COLLEGE, GORAKHPUR (U.P.) ²DEPARTMENT OF VEGETABLE SCIENCE, G.B.P.U. A. & T., PANTNAGAR (U.K.)

Nutritional deficiency is one of the major problems globally, especially in resource poor developing countries distressing the economical, social and personal growth simultaneously. Vegetable crops are recognized as the principal source of micronutrients, both macro and micro elements and loaded with phytonutraceuticals. This insight regarding the distinguished role of vegetables in nutritional security has steered to some efforts for improving nutritive quality further. There are so many vegetables which regarded as noteworthy sources for various minerals, vitamins, and as well as for valuable nutraceutical compounds of plant origin.

Improving quality parameters has become one of the main objectives of vegetable breeding as the public awareness related to nutraceutical compounds on human nutrition and health increasing day by day. During the course of domestication and genetic improvement of crop plants, several characters were left behind in the wild relatives, primitive, old and obsolete varieties. Extensive screening of germplasm to find out genetic variation, together with conventional breeding and effective selection procedures is prerequisite to breed novel genotypes with improved nutritional quality. Furthermore, elaborative research is essential to estimate the influence of growing environment and agronomic packages on these newly developed nutritionally enriched genotypes with standard cultivars. Different techniques based on molecular biology can be efficiently exploited to identify, map and clone the gene(s) that regulate the synthesis pathways of carotenoid, ascorbic acid and flavonoid. Bio-fortification at the crop level can be achieved through the transfer of genes conferring enhanced nutritional traits directly into elite breeding lines and generating transgenic plants.

Traits related to nutritional quality could be changed through hybridization followed by selection. However, successes of breeding for nutritional quality might not always have an optimistic influence on nutritionally lacking populations as other limiting factors also involved. To circumvent the disappointment of realizing the genetic alterations only to find out, that the nutritionally improved varieties are inappropriate or unproductive for improving nutritional condition. Therefore the feasibility or operability of genetic improvement for nutritional quality as a realistic approach must be cautiously determined before it is started.

Keywords: Breeding, nutraceuticals, Health.

THE UNRECOGNIZED BURDEN ON FAMILY CAREGIVERS OF DEPENDENT ELDERLY

PARUL KALIA¹, SARITA SAINI²

¹DEPARTMENT OF HUMAN DEVELOPMENT & FAMILY STUDIES, PUNJAB AGRICULTURAL UNIVERSITY, LUDHIANA

²DEPARTMENT OF HUMAN DEVELOPMENT & FAMILY STUDIES, PUNJAB AGRICULTURAL UNIVERSITY, LUDHIANA

Family caregivers have played an important role in our society for granting care to the aged. They are playing crucial in our care system by providing a significant quantity of health and long-term care for the aged person, chronically ill, disabled. The act of care-giving is not an easy task and can become more tedious when one is caring for a family member who is solely depending on the primary caregiver for everything. This situation could be the reason for many challenges which can affect the quality of life of the primary caregivers. The present research has made an attempt to assess the burden of stress among the family caregivers who were primarily responsible for care of dependent elderly. The sample included 60 families of caregivers who were having dependent elderly from the Ludhiana city. The Zarit Burden Interview developed by Zarit (1980) was used to measure the burden of stress on caregivers.

Key Words: BURDEN, FAMILY CAREGIVERS, DEPENDENT ELDERLY

EFFECT OF TYPE AND PERMEABILITY BEHAVIOUR OF PACKAGING MATERIAL ON QUALITY CHARACTERISTICS OF DRIED CARROT ROUNDELS DURING STORAGE

PRADEEP KUMAR*¹, N.S. THAKUR¹, K.D. SHARMA¹, HAMID¹ AND ABHIMANYU THAKUR¹

¹DEPARTMENT OF FOOD SCIENCE AND TECHNOLOGY, DR YS PARMAR UNIVERSITY OF HORTICULTURE AND FORESTRY, NAUNI, SOLAN, HP 173230, INDIA

Carrot (*Daucus carota* L) is a carotenoids rich vegetable which is mainly consumed raw, converted to various products and cooked vegetable dishes. The presence of handsome amount of the vitamins, bioactive compound including phenols and minerals have led this vegetable to rank it among top ten fruits and vegetables. Present studies were carried out to study the changes observed in quality

characteristics of dried carrot roundels during storage. Steam blanching and KMS dipping of carrot roundels followed by mechanical cabinet drying was found to be the best pretreatment for drying of carrot roundels as discussed earlier. These dried carrot roundels were further packed and stored under refrigerated (4-7 °C) and ambient (11.6-26.2 °C) storage conditions for 12 months. The dried carrot roundels packed in aluminium laminated pouches and stored under refrigerated conditions showed minimum increase in physico-chemical characteristics like moisture content (11.03 %), water activity (0.310), pH (6.04), reducing sugars (21.00 %), total sugars (35.36%) and retained highest amounts of titratable acidity (0.73 %), carotenoids (29.40 mg/100g), total phenols (87.50 mg/100g), crude fibres (4.16 %), rehydration ratio (7.81), antioxidant activity (52.68 %) and SO₂ content (174.75 ppm), respectively. The sensory characteristics scores like colour (8.05), texture (7.48), taste (6.88) and overall acceptability (7.54), respectively were also retained highest in the aluminium laminated pouch under refrigerated storage condition.

Keywords: Carrot (Daucus carota L), Roundels, Carotenoids, Aluminium laminated pouch and Polyethylene pouch.

EFFECT OF VITAMIN D IN ONCOLOGY PAEDIATRICS PATIENTS

DEEP SHIKHA, PROF.SUNITA MISHRA

DEPARTMENT OF HUMAN DEVELOPMENT AND FAMILY STUDIES, BABASAHEB BHIMRAO AMBEDKAR UNIVERSITY (CENTRAL UNIVERSITY) LUCKNOW.

1,25-dihydroxyvitamin $D_3[1,25(OH)_2D_3]$ is a well-known potent regulator of cell growth and differentiation and there is recent evidence of an effect on cell death, tumour invasion and angiogenesis, which makes it a candidate agent for cancer regulation.

Vitamin D status may influence this risk and so we assessed vitamin D levels in children with malignant disease undergoing active treatment or surveillance post-therapy.

Vitamin D levels [25-OH-D] are lower in survivors of childhood cancer in comparison to control children with the majority either insufficient or deficient. Assessment and adequate replacement of vitamin D status may be of particular value in this group of children. Vitamin D inadequacy can be prevented by sensible sun exposure and adequate dietary intake with supplementation. Vitamin D status is determined by measurement of serum 25-hydroxyvitamin D. The recommended healthful serum level is between 30 and 60 ng/mL. 25-Hydroxyvitamin D levels of >30 ng/mL are sufficient to suppress parathyroid hormone production and to maximize the efficiency of dietary calcium absorption from the small intestine. This can be accomplished by ingesting 1000 IU of vitamin D₃ per day, or by taking 50,000 IU of vitamin D levels with cancer morbidity and mortality. However, few studies have measured vitamin D in pediatric patients with malignancy. Our aim was to assess vitamin D status in a large cohort of pediatric patients with cancer and to define risk factors for deficiency.

Keywords: malignant, supplementation, paediatrics.

ANALYSIS OF EFFECTS OF TILLAGE PRACTICES ON RESOURCE CONSERVATION: STATISTICAL APPROCH

AGASHE NEHATAI WAMANRAO¹, VINOD KUMAR² AND DROMKUMAR MESHRAM³

DEPARTMENT OF MATHEMATICS, STATISTICS & COMPUTER SCIENCE, G. B. PANT UNIVERSITY OF AGRICULTURE AND TECHNOLOGY, PANTNAGAR, UTTARAKHAND, INDIA.

DEPARTMENT OF AGRONOMY, DR. PANJABRAO DESHMUKH KRISHI VIDYAPEETH AKOLA.

Soil compaction can increase unfavorable soil physical condition and suppressed the root growth of soybean. The effect of conventional tillage on soil physical properties were studied during the kharif season 2016-17. The field experiment which was arranged in strip plot design at the All India Coordinated Research Project on Weed Management Department of Agronomy, Dr. Panjabrao Deshmukh Krishi Vidyapeeth Akola. The object of these study is to analyze the effect of tillage practices on soil physical properties with respect to time. For these purpose the analysis multi-observation data (measurement taken over time) in strip plot RBD was used. From these study we concluded that tillage practices T1 (2 Harrowing by tyne cultivator + 1 Harrowing by blade harrow + Planking) and T2 (2 Harrowing by tyne cultivator + 1 Harrowing by blade harrow + Planking + Residue) is found to be superior out of all the practices. Therefore, it suggested that application of T1 and T2 tillage practices is beneficial for improving soil physical properties which ultimately increase the crop production.

Keywords: - conventional tillage, strip plot, soil compaction.

HIGH-TECH HORTICULTURE FOR IMPROVING NUTRITIONAL SECRUTITY IN INDIA

NANHE LAL SAROJ * RAMDEEN KUMAR

DEPARTMENT OF HORTICULTURE, ASSAM AGRICULTURAL UNIVERSITY, JORHA-785013, ASSAM (INDIA)*. DEPARTMENT OF HORTICULTURE, INSTITUTE OF AGRICULTURAL SCIENCES, BANARAS HINDU UNIVERSITY, VARANASI, 221005 (U.P.) INDIA

Horticulture is an integral part of food and nutritional security. It is an essential component of economic security of the stakeholder. Hi-tech horticulture is a technology which is modern, less environment-dependent and capital intensive but with a capacity to improve productivity and farmers' income. In the new era of changing climate, hi-tech horticulture has become necessity so as to sustain productivity and economic stability of the Indian farmers. Hi-tech horticulture is useful not only for production of fruits, vegetables and flowers but also for conservation, plant protection, post-harvest management including value-addition. The present article reviews various aspects of hi-tech horticulture hinting future prospects.

Key words: Hi-tech, horticulture, fruits, vegetables, flowers, post-harvest management

GENOME EDITING: A NOVAL TECHNOLOGY FOR ENHANCING PLANT DISEASE RESISTANCE

POOJA BHATT¹ AND K.P. SINGH²

DEPARTMENT OF PLANT PATHOLOGY, COLLEGE OF AGRICULTURE, GOVIND BALLABH PANT UNIVERSITY OF AGRICULTURE AND TECHNOLOGY, PANTNAGAR, U.S. NAGAR, 263145, UTTARAKHAND, INDIA.

The increasing numbers of infectious plant diseases that are caused by plant pathogens posing significant challenges to food safety and security. Developments of new strategies are necessary for enhancing plant disease resistance. Genome editing is a powerful tool for modifying genes, which are involved in the plant immunity system. Different genome editing (GE) techniques, like: clustered regularly interspaced short palindromic repeat (CRISPR)/CRISPR-associated protein 9 (CRISPR/Cas9) system, transcription activator-like effector nucleases (TALENs), zinc-finger nucleases (ZFNs) and LAGLIDADG homing endonucleases (mega nucleases), have so far been used for engineering disease resistance in crops. In recent years the use of GE technologies has grown very rapidly with numerous examples of targeted mutagenesis in crop plants, including gene deletion (knockout), gene deactivations (knockdown), modifications, and the repression and activation of target genes. Wide range of disease resistance has been engineered in crops by GE, either by targeting specific host-susceptibility genes (*S* gene approach), or by cleaving DNA of phytopathogens (bacteria, virus or fungi) to inhibit their virulence, propagation, etc. These GE techniques can play a vital role in providing molecular immunity in plants against the broad-spectrum of phytopathogens.

Key Words: CRISPER/Cas9, TALEN'S, ZFNs, S genes

FOOD TECHNOLOGY THEN AND NOW

POOJA SONI*1, DEVINA VAIDYA¹, SAKSHI SHARMA¹ AND VIVEK MEHTA¹

DEPARTMENT OF FOOD SCIENCE AND TECHNOLOGY, DR YASHWANT SINGH PARMAR UNIVERSITY OF HORTICULTURE AND FORESTRY, NAUNI, SOLAN, HIMACHAL PRADESH 173 230, INDIA

Food science is the discipline of applied science dedicated to the study of food. It is the application of basic sciences and engineering to study the fundamental physical, chemical and biochemical nature of food along with principles of food processing. Food scientists are interested in all aspects of food from production till its consumption because food interacts directly with people. Food technology is the use of information generated by food science in the selection, preservation, processing, packaging and distribution, as it affects the consumption of safe, nutritious and wholesome food. Food technologists deal with the conversion of raw agricultural products such as fruits into finished food products such as juice or beverages. Fruits and vegetables are processed to enhance storage stability, minimum packaging requirement and reduce transport weight. Preservation of fruits and vegetables through ancient methods based on hot water blanching, sun drying, manual harvesting which cause poor quality and product contamination. Innovative techniques of preservation of food increase the quality of product, nutritional value, reduce the cost, as it shortens the drying time and minimum damage to the product. Among the new technologies osmotic dehydration, microwave assisted drying and pulse electric field have great scope for the production of quality products.

Keywords: Food science, engineering, preservation, processing, packaging and distribution.

GENOME EDITING FOR CROP IMPROVEMENT

VARTIKA BUDHLAKOTI

DEPARTMENT OF GENETICS AND PLANT BREEDING, G B PANT UNIVERSITY OF AGRICULTURE AND TECHNOLOGY, PANTNAGAR

Genome-editing tools enable the precise and efficient targeted modification of an organism's genome. These technologies allow genetic material to be added, removed, or altered at particular locations in the genome using engineered nucleases. Foundational to the field of gene editing relies on the use of endogenous cellular repair machinery i.e. homology-directed repair (HDR) or non homologous end-joining (NHEJ) to repair targeted DNA double strand breaks (DSBs). Common nuclease-based platforms include zinc finger nucleases, transcription activator-like effector nucleases (TALENs), meganucleases and the CRISPR/Cas9 system. ZFNs consist of zinc finger protein domains, capable of sequence-specific DNA binding, fused to a nuclease domain for DNA cleavage. It was first shown in 2009 that genes of tobacco and maize could be modified with ZFNs. TALENs are similar to ZFNs and comprise a non-specific FokI nuclease domain fused to a customizable DNA-binding domain. This DNA-binding domain is composed of highly conserved repeats derived from transcription activator like effectors (TALEs), which are proteins secreted by Xanthomonas bacteria to alter transcription of genes in host plant cells (Boch and Bonas 2010). The RNA -guided Cas9 nuclease from the microbial clustered regularly interspaced short palindromic repeats (CR ISPR) adaptive immune system can be used to facilitate efficient genome engineering in eukaryotic cells by simply specifying a 20-nt targeting sequence within its guide RNA having 20 nucleotides at the 5' end that directs Cas9 to the complementary target site having 5' NGG PAM sequences. Cas 9 cleaves both strands (scissors) of target DNA sequence 3 bp upstream of the PAM. Shan et al. (2015) were able to create a fragrant variety of rice from a non fragrant variety using TALENs to knock out the OsBADH2 gene encoding betaine aldehyde dehydrogenase (BADH2). Zhang et al. (2019) used Agrobacterium- delivered CRISPR/Cas9 system and developed 69 wheat mutants for four grain regulatory gene, TaCKX2-1, TaGLW7, TaGW2 and TaGW8. Plant homozygous in TaCKX2-D1 significantly increased grain number per spikelet.

Key words: Engineered nucleases, Homologous direct repair, non homologous end joining, ZFN, TALEN, CRISPR-Cas.

VEGETATION STRUCTURE OF NATURAL FORESTS IN NAINITAL KUMAUN HIMALAYA, UTTARAKHAND, INDIA

BIJENDRA LAL AND L.S. LODHIYAL

DEPARTMENT OF FORESTRY AND ENVIRONMENTAL SCIENCE, DSB CAMPUS KUMAUN UNIVERSITY, NAINITAL-263002, UTTARAKHAND

Present study deals with the floristic composition and distribution pattern of the different plant species with reference to density, basal area, diversity and concentration of dominance in a moist sub temperate natural forest of Nainital in Kumaun Himalaya. The vegetation analysis

was done by placing random quadrates for tree, shrubs, and herbs. The size of quadrat was 10 x10m 5x5 and 1x1m for tree, shrub and herb in each forest site. In each quadrat, tree and shrub species were measured at 1.37m and 50cm from ground level. Density, abundance, basal area and IVI of trees was estimated in each forest site as followed by Misra (1968). Species diversity (H') of trees in each forest site was determined by using Shannon-Weiner Index (Shannon and Weaver, 1963). Concentration of dominance (Cd) was measured by Simpson's Index (Simpson 1949). The average number of tree, shrub and herb species was 5, 13 and 31 respectively in the study site. The density of tree, sapling and seedling was 700-920, 210-360 and 270-510 ind.ha⁻¹ respectively. While the shrub and herb density was 2060-2210 and 2970-3350 ind.ha⁻¹ respectively. Basal area of tree, sapling and shrub was 59.42-67.84, 0.68-1.36 and 0.26-0.34 m²ha⁻¹. Species diversity of tree, sapling, seedling, shrub and herb ranged from 1.82-1.97, 2.14-1.91, 1.58-1.80, 3.03-3.17 and 3.73-3.91 while the concentration of dominance was 0.29-0.31, 0.25-0.30, 0.31-0.37, 0.13-0.15 and 0.07-0.09 respectively. Based on the findings it can be concluded that vegetation structure of natural forest need the certain management inputs for their better conservation and development in the region. **Key words:** Natural forest, density, basal area, diversity, Kumaun Himalaya.

IMPACT OF ORGANIC MANURES AND DISTANCES FROM TREE TRUNK ON SOIL PHYSICO-CHEMICAL PROPERTIES IN *OCIMUM SANCTUM* UNDER STONE FRUIT BASED AGROFORESTRY SYSTEM SHIVANI SHARMA*¹ AND KS PANT¹

¹DEPARTMENT OF SILVICULTURE AND AGROFORESTRY, DR YS PARMAR UNIVERSITY OF HORTICULTURE AND FORESTRY, NAUNI, SOLAN, HP 173230, INDIA

A study was carried out at experimental farm of Department of Silviculture and Agroforestry, Dr YS Parmar University of Horticulture and Forestry, Nauni, Solan (HP) during the year 2016-2017 to elucidate the effect of different organic manures and their distance of application from tree trunk *viz.*, 1m, 2m and 3m away from tree on soil physico-chemical properties under Peach and Apricot based agroforestry system. The experiment was laid out in randomized block design (factorial) with seven organic manure treatments *viz.*, T_1 : Farm yard manure (FYM) 15 t ha⁻¹, T_2 : Farm yard manure (FYM) 20 t ha⁻¹, T_3 :Farm yard manure (FYM) 25 t ha⁻¹, T_4 : Jeevamrut (180ml/plant), T_5 : Jeevamrut (300ml/plant), T_6 : Jeevamrut (420ml/plant)and T_7 : control (no manure) and three distance treatments viz. 1m, 2m and 3m away from tree trunk, each replicated three times. The results revealed that different organic manure treatments significantly influenced the soil physico-chemical properties and FYM @ 25 t ha⁻¹ recorded highest soil moisture (11.20% and 11.27%), electrical conductivity (0.29 and 0.29), organic carbon (2.35% and 2.12%), available nitrogen (354.97 and 255.42), available phosphorus (55.08 and 53.88) and available potassium (356.40 and 278.96) when applied at a distance of 1m away from tree trunk under peach and apricot based agroforestry system, respectively.

Keywords: Jeevamrut, Ocimum sanctum, Peach, soil physico-chemical properties.



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Head Office: Gharda House, 48, Hill Road, Bandra (West), Mumbai - 400 050, INDIA. Tel: +91-22-3306 5600 Fax: +91-22-2640 4224 E-mail: npnair@gharda.com Website: www.gharda.com



Group Europe Office:

Croydon, CR9 6AD, England Tel: + 44 208 6554103 Fax: +44 208 6554102 E-mail: hpanchal@gharda.com npnair@gharda.com Website: www.gharda.com

U.S. Office:

660, Newtown Yardley Road, Suite 106, Newtown, PA 18940, U.S.A. Tel: +1 (215) - 9689474 Fax:+1 (215) - 9689574 E-mail: sramanathan@gharda.com Website: www.ghardausa.com



Gujarat Insecticides Limited Plot No. 805/806, GIDC, Anklehwar - 393002. Gujarat.

PRODUCT RANGE

E-mail: cbose@gilgharda.com dmirani@gharda.com Website: www.gilgharda.com

GS	Product Name	Purity	Plant Growth
Herbicides	Alpha Cypermethrin Technical	97% +	Mepiquat Chloride
	Cypermethrin Technical	93% +	
	Deltamethrin Technical	98% +	Vet Products
	Permethrin Technical	92%, 94% and 95% +	Product Name
	Chlorpyriphos Technical	98% +	Oxyclozanide
	Indoxacarb Technical	67% + and 95% +	Deltamethrin Tech
	Fipronil Technical	97% +	Cypermethrin Tec
	Diflubenzuron Technical	95% +	Permethrin Techni
	Quinalphos Technical	70% +	Fipronil Technical
	Profenophos Technical	94% +	
	Triazophos Technical	60% +	Intermediates
	Temephos Technical	92.5% +	Product Name
			Cypermethric Aci
	Product Name	Purity	Cypermethric Aci
	Anilofos Technical	93% +	High Trans CMA (
	Isoproturon Technical	97% + and 98% +	High Trans CMAC
	Dicamba Technical	97% +	Meta Phenoxy Ben
	Triclopyr Butoxy Ethyl Ester	97% +	Meta Phenoxy Ben
	Bispyribac Sodium Technical	98% +	Bromo Benzene

Int Growth Regulator

lepiquat Chloride

44/50% Aqueous Solution

t Products

eltamethrin Technical

permethrin Technical

rmethrin Technical

Public Health Products (WHO approved)

Product Name

Alpha Cyper Technical

Deltamethrin Technical 98.5%

Temephos Technical

Chlorpyriphos Technical

mennediates			
Purity			
99% +			
99% +			
99% +			
99% +			
99% +			
98% +			
99% +			



Uttarakhand Council for Biotechnology Biotech Bhawan, P.O. - Haldi-263146, Udham Singh Nagar,



Uttarakhand

Phone/Fax- 05944-230567

E-mail: statebiotech@rediffmail.com. website: www.ucb.uk.gov.in

The Uttarakhand Council for Biotechnology (UCB) was established in November 2015 aims to spread of Biotechnology Education Research and development program in State of Uttarakhand with establishment of biotechnology based industries for employment generation and economic development.

Future plan

- To set-up Biotechnology Park(s) and Incubation Centre and biotech based industries.
- To set-up biodiversity park and
- To upgrade and provide infrastructural support to R&D.
- Establishment of institutional framework for Biotech education, R&D.
- To set-up bio hi-tech centre with one drop more crop model.
- To intensify R&D work in potential areas of biotechnology and its interventions, including agriculture, horticulture, animal husbandry, human health etc.
- To promote large scale use of Biotechnology for the socioeconomic uplifment of weaker population.
- Biotech based Entrepreneurship development Programme.



Ongoing laboratory



Molecular Diagnostic Nano



Bio laboratory Analytical



Plant Tissue Culture Laboratory



Prof. (Dr.) Dinesh Kumar Singh Director, Uttarakhand Council of Biotechnology