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SUSTAINABLE AGRICULTURE-
INTERVENTIONS AND APPROACHES (CRTSAIA-2022)

26 - 27 March, 2022

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National Seminar
on
CLIMATE RESILIENT TECHNOLOGIES FOR SUSTAINABLE AGRICULTURE- INTERVENTIONS AND APPROACHES (CRTSAIA-2022)

(In Virtual Mode)

26 - 27 March, 2022

Seminar Proceeding

Editors

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Niranjan Kumar Chaurasia
P. Susmitha
Sanghamitra Rout
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DEPARTMENT OF GENETICS & PLANT BREEDING and SEED SCIENCE & TECHNOLOGY

M. S. Swaminathan School of Agriculture, Centurion University of Technology and Management, Paralakhemundi, Odisha-761211

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Prof. M. Devender Reddy,
Dean, M. S. Swaminathan School of Agriculture, Centurion University of Technology and Management, Paralakhemundi, Odisha-761211

MESSAGE

In India, for 58% population agriculture is the primary source of livelihood. According to State of Food Security and Nutrition in the World, 2020 report, nearly 14 per cent of the population (189.2 million) is still undernourished in India. The Global Hunger Index 2020 placed India at the 94th position among 107 countries. One of the critical challenges for a country's food security is climate change and its impact in the form of extreme weather events. The impact of climate change is directly or indirectly related to crop, water and soil as it influences the water availability, changes the intensity and frequencies of drought, effects microbial population, soil organic matter reduction, yield reduction, depletion of soil fertility as driven by soil erosion, etc.

The adaptation of appropriate mitigation technologies such as the cultivation of tolerant breeds to overcome the climate stress, water and nutrient management for efficient productivity and resource utilisation, crop monitoring through agro-advisories, and conservation agricultural practices are crucial to address the climate change and achieve sustainable development goals (SDG) in India. The approach of Climate-resilient agriculture (CRA) that includes sustainably using existing natural resources through crop and livestock production systems to achieve long-term higher productivity and farm incomes under climate variability is the need for achieving food security in the country. The National Seminar on Climate Resilient Technologies for Sustainable Agriculture Interventions and Approaches (CRTSAIA-2022) organized by M. S. Swaminathan School of Agriculture, Centurion University of Technology and Management, Odisha is one such attempt to put the agriculture technologies developed for meeting the climate change for sustainable agriculture production. The organizers have compiled the papers presented in the seminar and bringing it as proceedings that will serve for reference to researchers and various people dealing with agriculture that lead to sustainable agriculture development.

M. Devender Reddy

Dr. S. P. Nanda
Dean (Administration)
M. S. Swaminathan School of Agriculture, Centurion University of Technology and Management, Paralakhemundi, Odisha-761211

MESSAGE

It gives me great pleasure in sending this message to the Souvenir highlighting the theme of the national seminar "Climate-resilient technologies for sustainable agriculture- interventions and approaches" organized by the department of Genetics & Plant breeding and Seed Science & Technology, MSSSoA on 26th & 27th March 2022 through online mode.

Recently, the word "sustainability" has taken a prior role in every aspect of our life. As we are aware the UN has been trying to achieve the 17 sustainable development goals (SDGs) by 2030 so out of the 17 SDGs to achieve zero hunger and climate action, sustainability in agriculture is most important. Agriculture has a greater impact on climate change by several means as well as the food supply. So, to meet the food demand of the booming population and to check climate change there are several climate-resilient approaches that have come up with times.

The concerned topic has been presented and discussed by the participants felicitously and it was a great thing for me to be a part of it. I hope the Souvenir memorable and impressive.

S. P. Nanda

CONTENTS

Theme 1: Agri-Business and Marketing

Agritecture- An Approach toward Future in the Age of Climate Mitigation

Pravin L Chaudhary[1], Bijendra Kumar[2]*, Smita Kumari[3] & Rajneesh Kumar

[1, 2, 4]Department of Genetics and Plant Breeding, School of Agriculture.

[3]Department of Agronomy, School of Agriculture.

Lovely Professional University, Phagwara-144411, Punjab, India.

Corresponding author: Bijendra.18903@lpu.co.in

Abstract

Agritecture comprises of three word- Agriculture, Technology & Architecture. So, it is an art, science, and business of integrating agriculture into the building environment. By definition, Agritecture is science of applying architectural thinking when designing crop model in the artificial environment. Agritecture covers a wide range of global approaches like- Greenhouse crop production, vertical farming, aquaponics, aeroponics and hydroponics. Agritecture will help developers, and modern cities planers and launching successful urban agriculture and local food system projects. Agritectural Designer is planning many software that helps to develop urban agricultural ideas like precision farming, drought- and pest-resistant seeds, mobile phones mapping vis GIS, GPS, Remote Sensing and develop digital technology platforms. “Vertical farming" is transformation of indoor farming in controlled environment where crops are grown in vertically stacked layers. It is a method of growing crops like leafy greens and lettuce – usually without soil or natural light, in beds stacked vertically inside an artificial climate controlled-environment building. Agri. Tech. in Modern Farming empower and enhance many organizations to develop feasible urban farming solutions. Turn their business ideas into practical idea and sustainable Farming which feed the whole city. Today’s we are facing various constraints in adopting climate resilient agricultural practices due to limited knowledge on inadequate weather-based farm advisories. An architecture that defines home as both shelter & food and this Concept implementation of a closed-loop, self-sustained micro-farming system, as a proposal for

an Agritecture building design. Architectural interior space has living membrane made of micro farming units. Applying the Agritectural methodologies, the building envelope is designed to house the micro farming units which helps our upcoming generations and their food security. Climate mitigation is global challenge and Agritecture is a futuristic approach to cope with it.

Key words- Agritecture, remote Sensing, GIS, Hydroponics, Aeroponics, Vertical Farming.

Watermelon Fruit and Seed Production in Koppal District – An Economic Analysis

Veeresh[1], Prabhuling Tevari[1*] and Shivanand Kammar[2]

[1]Department of Agricultural Economics, University of Agricultural Sciences, Raichur, 584104

[2]Department of Agricultural Extension Education, University of Agricultural Sciences, Raichur, 584104

Corresponding author: ptevari@gmail.com

Abstract

The study on economic analysis of watermelon fruit and seed production was conducted in Koppal district, wherein the primary data was collected from Koppal and Yelaburga taluks. Koppal district was purposively selected for the study based on the highest area under watermelon cultivation in Kalyan Karnataka region. The study was conducted with the aim of estimation of cost of cultivation and a total of 45 watermelon fruit growers and 45 watermelon seed producers were selected randomly for the study. Tabular technique was used to estimate the costs and returns of watermelon fruit cultivation and seed production. The study indicated that the cost incurred to produce watermelon fruits and watermelon seeds from an acre were ₹ 43,787.83 and ₹ 74,771.75 respectively. The gross income earned by selling 11.75 tonnes per acre of watermelon fruit was ₹ 85,898.37 and by selling 89.50 kg per acre of watermelon seeds was ₹ 187,950.00. The cost and return analysis revealed that watermelon fruit and seed production in the study area was profitable with returns per rupee of investment (B: C ratio) of 1.96 and 2.51, respectively. The results

revealed that watermelon fruit and seed production was economically viable venture in the study area.

Key words- Watermelon, seed production, fruit production, cost, returns and Koppal

Co- integration of groundnut markets in India -An Econometric analysis

Murulidhar M. Venkannanavara[1], N. M. Kerur[2]

[1]Ph.D Scholar (Agribusiness Management), [2] Professor (Agribusiness Management)

College of Agriculture, Dharwad - 580 005, Karnataka, India

Corresponding author E-mail: mvmurulidhar@gmail.com

Abstract

The present study was undertaken to analyze groundnut market integration in six major regional markets located in Gujarat (Junagadh and Rajkot), Rajasthan (Bikaner and Jaipur) and Karnataka (Hubballi and Raichur) states of India were selected based on major arrivals of commodity to respective market, using monthly wholesale prices of groundnut during 2005 to 2020. Augmented Dickey-Fuller Unit root test indicated that the price series in each location are non -stationary at their levels, and stationary at their first differences. Co-integration results showed that the regional markets have price linkages and thus are spatially integrated. Johansen's multiple co-integration tests reveals that that their existence of at least five co-integration equations for selected groundnut markets based on likelihood-ratio test. Granger causality test explain that, there is existence of mostly bidirectional causality with few unidirectional causality among selected groundnut markets. The unidirectional relationship was found for the pair of Raichur market indicates that price of Raichur market influence the price of Rajkot and Hubballi market. Similarly, Hubballi, Junagadh, Rajkot, Bikaner and Jaipur exerted bidirectional causality among them. Thus, results of the study indicated a strong integration among major groundnut markets in India. It's clearly manifest that Raichur is the independent market for groundnut prices in south India and also their bidirectional relationships exist among the domestic markets, So, it is

confirmed that the price of one market influence the price of other markets. The test for causality is based on F statistics. Which indicated the price transmission happening in long run adjustments and the presence of short run equilibrium existed among the groundnut markets in India. Vector error correction estimates indicates that, extent of groundnut markets integration for different lags in the current study.

Key words- Unit root test (ADF), Johansen's multiple co-integrations, Granger causality, Independent market, Price transmission, Vector error correction.

Theme 2: Agricultural Biotechnology

Phytoremediation: An Approach towards Eco-friendly improving soil health

Rahul Singh[1*] and Hari Krishna[2]

[1]Department of Plant Breeding and Genetics, Bihar Agricultural University, Sabour Bhagalpur Bihar, 813210

[2]Department of Entomology, Bihar Agricultural University, Sabour Bhagalpur Bihar, 813210

e-mail: rahuldoc95@gmail.com

Abstract

An eco-friendly approach that could become successful mitigation practice to revegetate the soil having heavy metal-pollution i.e., phytoremediation. Heavy metal accumulation in soil is rapidly increasing due to various natural processes and anthropogenic activities. Nature of the heavy metals is non-biodegradable that leads to long term persistent in the environment. In addition, they have potential to alter the food chain through interring in crop plants. Due to their toxic nature, heavy metal accumulation has caused a severe threat to human health. Therefore, remediation of these contaminated land gained attention of the researchers. So, for the remediation, one of the ecofriendly techniques phytoremediation now has been becoming major practice. Subsequently many plants have been identified that can accumulate heavy metals in it termed as heavy metal hyperaccumulators. The purpose of heavy metal hyperaccumulators is the most straightforward approach for phytoremediation. But this could be taken very long time to clean-up heavy metal-contaminated soil. Requiring long time to cleanup heavy metal affected soil may be due to slow growth rate and production of low biomass of these hyperaccumulators. Therefore, improving plant performance realized to use of genetic engineering approach as a powerful tool to modify plants with desired traits to cleanup fast, high biomass production, high heavy metal tolerance and accumulation, and good adaption to various climatic and geological conditions. Genes involved in heavy metal uptake, translocation and tolerance can be altered to improve either heavy metal accumulation or tolerance in plants. In addition, microorganisms can be used to increase heavy metal bioavailability, which

facilitates heavy metal accumulation in plants leads to improvement in soil health and further promote plant growth and fitness. Single approach is not sufficient for effective clean-up of heavy metal-polluted soil. Thus, combination of different approaches, including natural hyperaccumulators, genetic engineering and microbe-assisted approaches may be beneficial for highly effective and exhaustive phytoremediation in the upcoming.

Key words- Phytoremediation, Heavy metal, Eco-friendly, Genetic engineering and microbe-assisted approaches.

Plant Biotechnology for Crop Improvement

U. Yashwanth[1], Niranjan Kumar Chaurasia[1], Krishnam Raju[1]

[1]Department of Genetics and Plant Breeding, M.S. Swaminathan School of Agriculture, Centurion University of Technology and Management, Odisha, India-761211

Abstract

Improvement of crop usually takes long period of time like ages(10-15yrs), because, after growing a group of plants we go for checking the plants which are performing better and how many are desirable, undesirable how they are giving good yield in next generation, and removing some of the unwanted plants and growing again after that trail in different locations after all these processes multiplication among the farmers and commercial distribution begins. In this not only breeding procedures also biotechnology methods are also required as we know that tissue culture has been developed, also some genetic engineering methods that means some genetic modified organisms (GMO) or we can call it as transgenic organisms like that so many were developed for the purpose of crop improvement. So many techniques are still developing to improve crop in different, different methods like applying some vaccines, somatic embryogenesis, all of these etc… so that there are a lot of chances in giving good yield also they will be very much beneficial for farmers.

Key words- Plant biotechnology, crop improvement, genetic modified organism

BIOFORTIFICATION OF RICE

Sona Chakraborty, Srinanda Mondal, Vemulapalli Haripriya and Durgadatta Meher

Department of Genetics & Plant Breeding, MSSSoA, Centurion University of Technology and Management, R.-Sitapur, Parlakhemundi, Odhisa

Abstract

Micronutrient malnutrition, commonly known as 'hidden hunger' mainly due to iron, zinc and pro-vitamin A deficiencies, has emerged as one of the major health problems worldwide. According to recent finding by WHO and FAO, around 3 billion people are at risk for zinc deficiency, 2 billion people are anaemic due to iron deficiency and about 150 million are deficient in vitamin A. Although many strategies including supplementation, dietary diversification, and commercial fortification of foods have been deployed to overcome this problem, however, these remedies pose several problems due to incapability of the target populations to consume balanced and supplementary diets. Rice is the major staple food and source of energy for more than half of the world's population. In comparison to other cereal crop rice contains meagre amount of micro nutrient like protein (6-7 %), Zn (10-33 ppm) and Fe (2-34 ppm) and deficit in pro-vitamin A. Unfortunately, due to gradual genetic erosion the genetic store house of land races and traditional varieties are gradually depleted by high yielding varieties which are poor source of essential micronutrients such as Zn, Fe and pro-vitamin A in their polished (white) form. Therefore, genetic bio-fortification of rice with enhanced levels of pro-vitamin A, Zn and Fe may be a cost-effective and sustainable solution to assist in combating micronutrient malnutrition. Biofortified rice can be developed by traditional breeding methods, exploiting the genetic variation present in folk rice cultivars through selection and hybridization program.

TAKE STEPS TOWARDS CLIMATE RESILIENT IN AGRICULTURE

Rupali Behera

PG Scholar, Department of Genetics and plant breeding, Centurion University of Technology and Management, Paralakhemundi, Odisha-761211, India

Abstract

National Innovations on Climate Resilient Agriculture (NICRA) project was organized by ICAR in 2011 to develop technology for climate- resilient agriculture through strategic research. Climate resilience is a management concept for biotic and abiotic stress environment or any climate risk to protect crop. Climate change effect our food chain which harm crop yield. Day by day human population increase and people also want more food for survive. They also prefer good quality food. In this situation agriculturist produced genetic modified crop which resistance and tolerance to any climate change (Biotic and Abiotic stress). Farmer use genetic modified crop which is not required chemical use in farm field. It helps to protect environment from chemical use. It gives good yield with good quality.

ROLE OF EPIGENETICS IN CROP IMPROVEMENT

Ponselvan. A[1], Sangamitra Rout[2], Pusarla Susmitha[2], Satyabrata Nanda[3]

[1]M.Sc. scholar, Department of Genetics and Plant Breeding, MSSSoA, CUTM, Gajapathi, Odisha-761200

[2]Assistant professor, Department of Genetics and Plant Breeding, MSSSoA, CUTM, Gajapathi, Odisha-761200

[3]Assistant professor and Head, Department of Biotechnology, MSSSoA, CUTM, Gajapathi, Odisha-761200

Abstract

Epigenetic is one of the grounds breaking research topic, which deals with the regulation a number of plant systems from cell differentiation to inheritance of a trait. Epigenetics is

the study of inheritance of phenotypic changes, which aren't due to the change in DNA sequences. Even though, these changes are stable and persist generation after generation, environment factors could influence the alternation in the epigenetic traits. Many of the epigenetics effects are brought as the result of change in chromatin structure by DNA methylation, histone modification and interactions of small RNA. Small RNAs plays an important role in maintenance of genome integrity, development, metabolism, and adaptive responses toward environmental stresses. RNA-associated epigenetic phenotypes are produced by siRNA molecules that silence genes and transposable elements by directing DNA methylation or histone modifications to specific DNA sequences. In addition, research has demonstrated that epigenetic processes such as methylation and histone modification influence the expression of microRNAs, which, in turn, play an important role in regulating other genes. MicroRNAs also control the expression of genes that produce epigenetic effects, such as those encoding enzymes that methylate DNA and modify histone proteins. Yet, How RNA-based epigenetic changes are maintained across cell divisions is less clear, although some small RNAs are transmitted through the cytoplasm. Epigenetics holds great potential for the improvement of plant varieties with respect to yield and nutritional quality by creation of novel epialleles. Studies of epigenetic responses to different stresses can increase our understanding of plant stress adaptation and mechanism underlying them which can be further exploited for the development of improved crop varieties.

CRISPR/Cas 9 based genome editing in plants

S. R. Harish Chandar* Pusarla Susmitha G. Pushpalatha

[1]Department of Genetics and Plant Breeding, MS Swaminathan School of Agriculture, Centurion University of technology and management, Odisha.

[2]Department of Plant Biotechnology, MS Swaminathan School of Agriculture, Centurion University of technology and management, Odisha.

******Corresponding author E-mail:* harishchandar1998@gmail.com

Abstract

Enhancing agricultural production through innovative breeding technology is required to increase the availability of nutritious food worldwide. Recently genome editing technology

has shown great potential in improving agricultural production. Recent advances in genome editing through CRISPR/Cas9 has enabled efficient targeted mutation in most of the crops to accelerate crop Improvement. The CRISPR/Cas 9 system is an RNA guided genome editing tool that consist of a Cas9 nuclease and a single guided RNA (sgRNA). By base pairing with a DNA target sequence, the sgRNA enables Cas9 to recognize and cut specific target DNA sequence generating double stranded breaks that trigger cell pair mechanism near the double strand break sites. Since it's discover the CRISPR/cas9 system has been widely used to edit the genomes of different range of crop plants. It can be used to add a desirable allele and remove an undesirable allele simultaneously in the same event. Application of these techniques will result in development of modified crops with desirable traits that can contribute to enhance agricultural production.

Key words- CRISPR/Cas9, genome editing, crop breeding, targeted mutagenesis,

Plant Transcription Factors in Drought Stress Responses: Their Potentials in Crop Improvement

Digvijay Singh[1], Satyendra[1], Sweta Sinha[2], Mankesh Kumar[1], Swapnil[1] and Zafar Imam[1]

[1]Department of Plant Breeding and Genetics, Bihar Agricultural University, Sabour-813210, Bhagalpur, Bihar, India

[2]Department of Agricultural Biotechnology and Molecular Biology, Bihar Agricultural University, Sabour-813210, Bhagalpur, Bihar, India

Corresponding author: digvijaysingh841226@gmail.com

Abstract

Plants often encounter unfavorable environmental conditions because of their sessile lifestyle. These adverse factors greatly affect the geographic distribution of plants, as well as their growth and productivity. Drought is the major environmental factor that limits crop growth and yield globally. Improving crop performance under water limiting conditions is, therefore, an important research focus of plant scientists around the world. Transcription

factors (TFs) play important roles in drought tolerance by stimulating plant's protective genome activities in response to heat and water limitation. TFs are specialized proteins which can bind to specific DNA elements in gene promoters and modulate gene expression in response to various external and internal stimuli. Thus, TFs is a crucial part of plant signal transduction pathway mediated by signal receptors, phytohormones and other regulatory compounds. The activities of TFs are closely related to their structure, and their binding specificity is determined by the homo-/hetero-dimerization of TFs. Many TFs belonging to families AP2/EREBP, bZIP, MYB, WRKY, and NAC have been reported to participate in plant responses to various stresses. A number of TFs whose encoding genes are appropriately altered in expression level have shown enhanced tolerance capacity toward drought, salt, and suboptimal temperatures in transgenic model and crop plants. Thus, the hierarchic regulations of TF activities, downstream gene expression and protein–protein interaction comprise a complex regulatory network, which participates in drought response and adaptation in cereal crops. Hence, in this study we summarize our current understanding about TF activities and their use for enhancing cereals adaptation to drought stress.

Key words- Transcriptional factor, drought tolerance, adaptation, families

Developmental trait analysis under salt and drought stress among maize (*Zea mays.L*) genotypes

S.Veera Vishnu[1], Dr. Pushpalatha G[2]

[1]Department of Genetics and Plant Breeding, MSSSoA, Centurion University of Technology and Management, Odisha

[1]Department of Plant Biotechnology, MSSSoA, Centurion University of Technology and Management, Odisha

Abstract

Transposable elements make important contributions to adaptation and evolution of their host genomes. The well-characterized transposase-derived transcription factor FAR-RED ELONGATED HYPOCOTYLS3 (FHY3) and its homologue FAR-RED IMPAIRED RESPONSE1 (FAR1) have crucial functions in plant growth and development. . In addition, FHY3 and FAR1 are the founding members of the FRS (FAR1-RELATED

SEQUENCE) and FRF (FRS-RELATED FACTOR) families. We demonstrated experiment in maize genotypes under salinity and drought stress in lab conditions. By using different FRS marks in microarray expression analysis in protein level.

Key words- FAR1; FHY3; FRS gene family, molecular domestication, microarray expression analysis.

Biotechnology for Agriculture – Is it Sustainable?

Kakani Grihalakshmi

School of Management, Centurion University of Technology and Management, Odisha, India

Email: Kakani.Grihalakshmi@cutm.ac.in

Abstract

Agriculture for ages has been the backbone of major economies across the globe and continues to be the only source of livelihood for small and marginal farmers. Crop production practices have seen major shifts from subsistence farming with cultivation of traditional (wild) varieties adhering to traditional practices to green revolution and to modern transgenic crops**.** Gene modification for improved crop varieties has been in vogue for centuries. Several plant varieties were selectively bred over hundreds of years into domesticated food plants. A process known as Artificial Fertilization was used wherein an elaborate procedure involving collection and application of pollen onto the stigma yielded hybrids with desirable traits. Green revolution had brought in plant varieties resistant to biotic and abiotic stresses by carrying out crosses between several related species. A more precise gene manipulation by specifically combining genes from one organism into another commonly referred to as Genetic Engineering came into existence. Plant breeding for pest resistance has been considered the most critical application of genetic engineering. Transgenic crops especially cotton and maize were being developed by inserting genes from *Bacillus thuringiensis* to prevent pests. It is quite intriguing though that modern approaches with gene manipulation have had limited success. Emerging issues such as climate change, low agricultural productivity, new diseases and pests continue to pose challenges in meeting the food requirements of the growing population. This warrants a

system or an approach with practices that are sustainable and that can withstand the vagaries of the climate. Biotechnology has had its presence for about fifty years for now but has remained very controversial all through in its methods. It is considered that introduction of novel traits with taxonomically different organisms can have intense negative impact on the environment bringing about changes in the genetic makeup of the population.

Key words- Genetic Engineering, Transgenic, Conventional, Environment, Sustainability

CONVENTIONAL TO MARKER ASSISTED SELECTION IN PLANT BREEDING

Cheguri Prathyusha*[1], Thalari Vasanth[2], Shatrudhan Kumar Choudhary[3]

Department of Plant Breeding and Genetics

[1,3]Bihar Agricultural University, Sabour, Bhagalpur-813210, Bihar, India

Assam Agricultural University, Jorhat-785013, Assam, India

Email: prathyushachegurich@gmail.com

Abstract

The rate of yield increment by most crop breeding efforts is insufficient to meet the increasing food demand caused by a rapidly growing global population. A new cultivar can take one or two decades to develop due to the various stages like crossing, selection, and testing needed in the production of new plant varieties. One option for addressing food scarcity and increasing food security is the rapid production of improved plant varieties. Breeders are highly interested in new technologies that can speed up or improve this process. The recent integration of biotechnology, genomic research, and molecular marker applications with conventional plant breeding procedures has laid the groundwork for molecular plant breeding, an interdisciplinary science that is revolutionising crop improvement in the recent times. As more genes are identified and their functions and interactions are described, marker assisted selection will become more valuable; however, reduced costs and optimal methodologies for integrating MAS with phenotypic selection are required before the technology can reach its full potential. Overall, marker assisted selection has shown to be an extremely beneficial plant breeding approach. By using these

techniques plant breeders have been able to develop cultivars of agriculturally important plants with genes for disease resistance, stress resistant along with high yielding ability that were earlier impossible to achieve before the invention of DNA technology. Although there may be overlap between these categories, we have classified these schemes as follows: marker-assisted appraisal of breeding material; marker-assisted backcrossing (MABC); marker-assisted recurrent selection (MARS); gene pyramiding; early generation selection; and combined MAS. In general, DNA markers have been included into traditional schemes for line development or have been utilised to replace traditional phenotypic selection.

Key words- Conventional Plant Breeding, Molecular Plant breeding, Marker Assisted Selection, Gene Pyramiding, Early generation selection, Combined MAS

CRISPR: The new frontier of Genome Engineering in crops

Swapnil[1]*, S.S. Mandal[1], KumariRashmi[1], Sweta Sinha[2], Birender Singh[1]and Sanjay Sahay[3]

[1]Department of Plant Breeding and Genetics, Bihar Agricultural University, Sabour, Bhagalpur, 813210

[2]Department of Molecular Biology and Genetic Engineering, Bihar Agricultural University, Sabour, Bhagalpur, 813210

[3]Department of Horticulture (Fruit and Fruit Technology), Bihar Agricultural University, Sabour, Bhagalpur, 813210

Corresponding author: versatilerash@rediffmail.com

Abstract

Traditionally, generation of new plants with desirable features has trusted on painstaking and time-consuming breeding methods. Genome editing (GE) has revolutionized biological research through the new ability to precisely edit the genomes of living organisms. Advancements in genome editing technologies such as zinc finger nucleases (ZFNs), transcription activator-like effector nucleases (TALENs) have made it possible for molecular biologists to more precisely target any gene of interest. These methodologies are expensive and time-consuming as they involve complicated steps that require protein

engineering. However, recent advances in Clustered Regularly Interspaced Short Palindromic Repeats (CRISPR)/Cas genome editing enable efficient targeted modification in most crops, thus promising to accelerate crop improvement. (CRISPR)/Cas9 system has widely been used in GE due to its high efficiency, ease of use, and accuracy. Genome editing with site-specific nucleases allows reverse genetics, genome engineering and targeted transgene integration experiments to be carried out in a precise manner. It involves the introduction of targeted DNA double-strand breaks (DSBs) using an engineered nuclease, stimulating cellular DNA repair mechanisms. Two different DSB repair pathways have been defined: non-homologous end joining (NHEJ) and homologous recombination (HR). The application of CRISPR/Cas9 and related technologies in plant engineering will not only enable molecular breeding of crop plants but also accelerate progress in basic research. Application of these methods will result in the development of non-genetically modified (non-GMO) crops with the desired trait that can contribute to increased yield potential under biotic and abiotic stress conditions.

Key words- CRISPR, recombination, Cas9, genome, editing

Biotechnology in Agriculture

Jyothsna Sirisha

Centurion University of Technology and Management, Paralakhemundi, Odisha

Email: 190804130016@cutm.ac.in

Abstract

Biotechnology is one of the fastest growing areas in science that made a great development in various fields such as agriculture, medicine, pharmacy and environment science. In fact, biotechnology is the science and technology of peaceful and humanitarian use of living things to human welfare and environmental protection. Along with the development of this technology, sustainable agriculture has taken into account. Biotechnologists believe that the biotechnology is like a miracle and could help us to achieve sustainability in agriculture. Biotechnology improves production, saves time and money and causes reduction in chemical application. Nonetheless, other aspect of biotechnology such as socioeconomic

aspects are usually ignored. On the other hand, traditional agriculture, irrespective of the application of this technology in sustainable agriculture believes that these advantages are temporary and even are considered as serious threat for ecosystem in long term. Sustainable agriculture is a holistic approach in which proper management of natural resource are practised to supply human needs for food and other goods. To pass through this way, considerable changes are needed in the structure of political approaches and the research companies to produce products meeting ecological, socioeconomic criteria. To achieve such changes, it is necessary for authorities to reconsider the relationships between farmers, industry, consumers and universities.

Theme 3: Agriculture Engineering

Studies on Wear Characteristics of Agricultural disc

Annu Rani[*1], T. P. Singh[1], Jayant Singh[1]

[1]Department of Farm Machinery and Power Engineering, Govind Ballabh Pant Agriculture and Technology. Pant Nagar, Uttarakhand

Abstract

An experiment was conducted to determine the wear of various makes (M1, M2, M3 and M4) of discs as weight reduction, radius reduction and thickness reduction in circular soil bin; and the effect of different soil (sand and silty-clay-loam), operating speed *viz.*2.5, 3.5 and 4.5 km/h and soil moisture content on wear was taken into consideration. The data obtained from the laboratory test was then compared to the field test conducted at soil moisture content of 12-14 % with 4.5 km/h forward speed and depth of operation as 10 cm. The test was conducted in rice harvested field with duration of work 100 hours. According to both field and laboratory conditions, mathematical correlations were developed relating wear to different operating conditions. It was observed that in field conditions the cumulative wear (in terms of weight loss) was 1.79, 1.75, 1.85 and 3.49 times more than the laboratory conditions for discs M1, M2, M3 and M4, respectively. In terms of radius reduction, the wear was 1.89, 1.72, 1.61 and 1.79 times more whereas in terms of thickness reduction, the wear was 2.26, 2.19, 2.24 and 2.27 times more at grid point A to 0.585, 0.535, 0.488 and 0.429 times more at grid point H in the field test than the laboratory test for discs M1, M2, M3 and M4, respectively. This increase in wear may be due to the wide range of abrasives available in the actual field condition and more compactness.

Key words- Wear loss, Circular soil bin, Sand, Silty clay loam

Non-conventional water resources for sustainable agriculture

Sonu Saw[1], Biswajeet Kuldeep[1], Debashish Rath[1] and Amit Biswas[2]

[1]B. Tech Student, Department of Agricultural Engineering, School of Agriculture & Bio-Engineering, Centurion University of Technology and Management, Odisha, India

[2]Assistant Professor, Department of Agricultural Engineering, School of Agriculture & Bio-Engineering, Centurion University of Technology and Management, Odisha, India

Abstract

Climate change is a major global challenge in the 21st Century. The effects of climate change on water availability are well documented with projections indicating an increase in water stress due to decreasing fresh water availability, ultimately resulting in increasing non-conventional water reuse for agriculture. Climate resilient non-conventional water treatments must be practiced to protect human health, agriculture and environment. Hence, a field study was carried out with lettuce plant under polycarbonate polyhouse at Centurion University of Technology & Management, Paralakhemundi from 1st October 2021 to 15th December 2021, with three different types of water i.e., a) Fish Pond Water b) Waste Water and c) Fresh Water with the aim of reutilization of non-conventional water resource in an effective way. There were six pots for each water treatment having a surface radius of 11 cm and a height of 18 cm. The average temperature and relative humidity maintained during the experiment was of 26.3 °C and 46% respectively. After harvesting it was found that the weight of leaves of fish pond water pot, waste water pot & fresh water pot was 207.5 gm, 233.5 gm & 310 gm and root length was of 14.25 cm, 12.25 cm & 17.1 cm respectively. Water Productivity in gm/cc for fresh, waste, fish pond water was found as 23, 29, 25 respectively and water footprint in cc/gm was found as 43.48, 34.61 and 38.54 respectively. At the end the waste water pot showed the highest water productivity with least footprint followed by fish pond water pot and fresh water pot.

Key words- Climate Change. Waste water, Lettuce, Water footprint

USE OF NANOTECHNOLOGY IN AGRICULTURAL PRODUCTS

Maibam Meeneca, Rashmi K[2], Vinay Kumar[2] and Krishnam Raju[3]

M.Sc. Research Scholar of M.S Swaminathan School of Agriculture in Centurion University of Technology and Management

[2]Assistant Professor in Genetics and Plant Breeding of M.S. Swaminathan School of Agriculture in Centurion University of Technology and Management

[3]Associate Professor in Genetics and plant breeding of M.S. Swaminathan School of Agriculture in Centurion University of Technology and Management

Abstract

Nanotechnology is the art and science of manipulating and rearranging individual atoms and molecules at nano scale to create useful materials, devices and systems. Nanotechnology can contribute to enhancing agricultural productivity in a sustainable manner, using agricultural inputs more effectively, and reducing by-products that can harm the environment or human health. Nanotechnology applications in basic agriculture, value addition, preservation of crops and food can therefore bring a sea change in the agriculture scenario of India. Thus, applications of nanotechnology in agriculture can prove to be a big boon. In the field of agriculture, there are still many possibilities to explore and a great deal of potential with up-coming products and techniques. There is an urgent need for informed public debate on nanotechnology agriculture and food. There are currently several dozen food and beverage products with nanotechnology on the market according to their producer or experts. Governments and food companies in several countries are investing in hundreds of projects developing nanotechnology in food and agriculture. Nanotechnology can be applied in all aspects of the food chain, both for improving food safety and quality control, and as novel food ingredients or additives, which may lead to unforeseen health risks. Nanotechnology will play a vital role in the development of the agricultural sector, as it is capable of being used in agricultural products that protect plants and monitor plant growth and detect diseases.

Key words- Nanotechnology, agriculture, food chain, fertilizer, pesticides.

Analyzing the Influence of Climatic Extremes on Hydrologic Characteristics in Damodar River Basin

Uday Pratap Singh Bhadoriya[1], Ashok Mishra[1], Rajendra Singh[1]

[1]Agricultural and Food Engineering Department, Indian Institute of Technology Kharagpur, West Bengal, India

Abstract

Climate change impact evidences on hydrology or streamflow is already noticed by various studies. The resultant impact is aggressively evident on hydroclimatic extremes i.e., floods, droughts, heatwaves, cyclones. Most of the river basin have dams/reservoirs constructed across the river to store the water for water supply purposes. Thus, changes in streamflow or inflows to reservoirs affect the reservoir's operation and management. Many studies tried to assess the impact of climatic changes on streamflow/reservoir inflows, however, a very few of them analysed the climatic extremes relationship with the inflow characteristics (and extremes). This study attempts to find the influence of precipitation and temperature-based extremes on the reservoir inflows in Damodar River basin. Multiple precipitation and temperature indices are selected, and estimated for 1980-2014. Results indicate that the high precipitation extremes have greater positive correlation with high streamflow events. Continuous dry days (CDD) are strongly negatively correlated to average daily flow. Continuous wet days (CWD) are strongly positively correlated to high stream flows. Warm spell duration index (WSDI) shows negative association with minimum stream flows, thus indicating reduction in streamflow with increase in temperature. The approach and findings of this study may help the policy makers and managers to plan resources accordingly.

Key words- Climate change, climate extreme indices, hydrological extremes, precipitation extremes, temperature extremes.

IOT based photovoltaic operated drip irrigation system

Papri Mukherjee, Samprita Nayak, Abhishek Bibhar, Pragnee Priya Singh and Subhankar Debnath

Agricultural Engineering Department, Centurion University of Technology and Management, Odisha

**Correspondence Author email:* subhankar.debnath@cutm.ac.in; Mobile (whatapp): 9046403822

Abstract

Agriculture sector is the back bone of Indian economy. India secured second position in terms of producing agriculture output. Irrigation water is primary input for crop production and in most of the time source of power is from electricity or fossil fuel. In recent times focus of research shifted towards utilization of renewable energy resources like solar and wind energy for pumping the water. Solar operated drip irrigation system is eco-friendly and economically viable to small scale farmers. Normally these pumps and motor irrespective of power used were operated manually and sometimes this may results in over irrigation and wastage of water. Operating pump automatically without involving human being may be the better solution to overcome this situation. Wireless sensors were used to sense the moisture level in the soil to automate the irrigation system. Solar operated drip irrigation system can be automated using sensors, timers or mechanical appliances. In present study, standard data regarding the moisture level of a soil was predefined for a specific moisture content. The sensor transmits the data through a microcontroller to the server in fixed time interval. If the soil moisture was below the benchmark value of moisture, the microcontroller will start the pump for irrigating the crops till the moisture of soil reached the field capacity. After moisture level of soil reaches to field capacity, the power may turn of for the pump through microcontroller. The IoT based solar operated drip system may solve many problems related to irrigation systems operated using conventional energy sources. This IoT technology also prevents the wastage of water with periodical monitoring of soil moisture and minimizes the labour requirement to operate the pump.

Key words- IoT, Solar panels, photovoltaic cell, drip irrigation, Micro controller.

Determination of photovoltaic cell size for irrigating banana using drip irrigation

Arindam Chattaraj, Raju Giri, Ashish Kumar Senapati and Santosh D.T*

Agricultural Engineering Department, Centurion University of Technology and Management, Odisha

Correspondence Author email: santosh.dt@cutm.ac.in; Mobile (whatsapp): 9735267433

Abstract

Gradually decreasing energy sources and increasing demand for energy in recent years, makes more efficient and positive use of current water resources. The demand of electricity in irrigation is growing up since the cost of an electric powered pump is lower compared to a diesel engine driven pump. Solar operated pump may be an alternative for small scale drip irrigated crop production. The high initial investment for photovoltaic power makes it necessary to calculate dimension of photovoltaic panel as accurately as possible. The primary objective of the study is to estimate the design requirements of a photovoltaic system to power the drip irrigation (photo irrigation) for banana in Gajapati District of Odisha state. Reference crop evapotranspiration was estimated using FAO-56 Penman Monteith approach using climatic data recorded at campus of Centurion University of Technology and Management, Paralakhemundi. The total water requirement of banana was estimated to be 1315 mm. The analysis shows that the maximum daily irrigation need of banana under drip irrigation for 1 ha is about 69.27 m^3 in the month of May. The maximum daily power required to pump 69.27 m^3 volumes to 25 m elevation is estimated as 2.6 kWh day^{-1}. The power requirements for pump to operate drip irrigation can be met with quite a small area of solar PV in the order of 21.45 m^2, or 0.21% of planted area. Present study showed encouraging results of solar panels usage in terms of the area required to house them to be used to generate power for the pumping requirement for drip irrigation of banana in a one-hectare plot.

Key words- Solar panels, photovoltaic cell, drip irrigation, penman monteith equation.

Theme 4: Agriculture Extension and Technology Dissemination

Agriculture Extension Approaches for Climate Resilient Technology for Sustainable Agriculture Cases from Odisha and North Eastern States

Biswajit Mallick*[1] & Sudhanand Prasad Lal[2]

[1]Research Scholar & [2]Assistant Professor cum Scientist Department of Extension Education

Dr. Rajendra Prasad Central Agricultural University, Pusa, Samastipur, Bihar-848125

Corresponding author email id: biswajitmallick9999@gmail.com

Abstract

Agriculture Sector would be exacerbated by increased climate variability. Climate resilience is the ability to predict, prepare, and respond to hazardous events, or disturbances related to climate. Intensive plans are required for mitigation and adaptation to reduce the vulnerability of Indian agriculture to the adverse impacts of climate changes and make it more resilient. A wide range of extension approaches are proposed by both government and non-govt. organizations in dissemination of climate resilient technologies. North Eastern states are more vulnerable to floods whereas the state Odisha is affected by cyclones every year estimates huge loss to agriculture, livestock and livelihood sectors. A few approaches highlighted in the abstract to give a better insight towards agricultural sustainability in vagaries of climate change

Key words- Climate Change, Extension Approaches, Resilience, Vulnerable

Nutritional awareness and status of women in child bearing age in slum areas of Bihar

Akanksha Priya[1*], Anju Singh[2], and Vinay Kumar[3]

[1&2]P.G. Department of Home Science- Food & Nutrition,

Tilka Manjhi Bhagalpur University, Bhagalpur, Bihar, India - 812007

[3]Department of Genetics and Plant Breeding, M S Swaminathan School of Agriculture,

Centurion University of Technology and Management, Odisha, India - 761 211

*_Email_: apfeb03@gmail.com

Abstract

The present study was conducted in the slum areas of Nathnagar, Bihar and its surrounding areas to know about the nutritional and health conditions of the female respondents residing in these areas. For the collection of data questionnaire and schedule was formulated and observation and interview method were applied for the scientific research. For this assessment mostly the primary data were collected. All the collected data were analyzed after proper tabulation, graphs and photographs were also used to make the research work relevant and more scientific. Populations of studies were the females of Nathnagar block and its surrounding areas. A cross sectional study was conducted based on our conceptualization of nutrition awareness and questionnaire-based studies of a face-to-face interview. The samples were women with age group of 17 years to 45 years. In the present study, sampling method has been used instead of using census method due to the vastness of the whole. Considering each unit of the whole as equal, 500 units were selected as a model by the convenient method of non-probability sampling method. Females of Nathnagar (of slum areas) and surrounding areas were taken as samples (both Hindus and Muslims). In this way 500 samples were taken under consideration and were chosen randomly. The nutritional status of respondent was assessed by observing height and weight, knowing about the dietary intake and dietary habits and food consumption patterns of the slum dwellers.

Key words- Nutritional Awareness, women, Child Bearing Age, Slum Areas, Bihar

Management orientation of permanent migratory shepherd households

Geeta Gadekar[1], Dr. Annapurna Kalal[2], Dr. Shobha Nagnur[3], Dr. V. R. Kiresur[4] and Dr. V. S. Kulkarni[5]

[1]Ph.D Scholar (Extension and Communication Management),[2 and 3]Professor (Extension and Communication Management),[4]Professor (Agricultural Economics) and [5]Professor (Animal Science)

College of Community Science,

University of Agricultural Sciences, Dharwad-580005

Email: geetagadekar35@gmail.com and pujarac@uasd.in

Abstract

The present study was conducted to know the management orientation of sheep among permanent shepherd households. A total of 120 respondents were selected with the snowball sampling method. The results shows that cent per cent (100.00 %) of the shepherd men agreed for the statements 'diversification of the flock with new breed', 'predetermination of migration routes to avoid en route problems' and 'prior decision about the new breed'. In case women, an equal per cent (73.30 %) agree with 'predetermination of migration routes to avoid en route problems' and 'prior decision about the new breed'. Cent per cent (100.00 %) agreed with the statement 'migration helps to fulfil the need of fodder and water scarcity'. Sizeable per cent (73.30 %) of women agreed with statements 'the concentrates should be fed depending on the age to reduce cost of production'. Considerable per cent (66.70 %) of shepherd men agreed with statement 'shepherd can get good price by selling his produce directly to the consumers by not involving any intermediaries' followed by migratory sheep fetches better market price (60.00 %). Regarding women, sizeable per cent (73.30 %) agreed that 'migratory sheep fetches better market price, shepherds can get good price by selling his produce directly to the consumers by not involving a any intermediaries (38.30 %). Large segment of the sample (95.00 %) belonged to medium category of management orientation and only few 05.00 per cent of men belonged to low management orientation category respectively. With regard to women, 66.70 per cent of women belonged to medium category and rest (33.30 %) of the women belonged to low management orientation category. Hence, the study suggests to plan and implement various extension activities and other services to increase the management orientation of sheep rearing for better planning,

production and marketing orientation of sheep to make sheep farming as a sustainable and profitable enterprise.

Key words- Planning orientation, production orientation, marketing orientation and profitable enterprise

ASSESSMENT OF OCCUPATIONAL HEALTH HAZARDS AND USE OF SAFETY MEASURES (PPEs) AMONG DAL MILL WORKERS IN KALABURAGI DISTRICT OF KARNATAKA STATE

[1]DEEPAK,* [2] K. V. JAMUNA.

[1]Ph.D. Scholar, Department of Food Science and Nutrition.

[2]Professor, Department of Food Science and Nutrition.

University of Agricultural sciences, GKVK, Bengaluru-65.

E-mail: deepaks.uasb@gmail.com

Abstract

Kalaburagi district is major pulse producing and processing district of Karnataka and it is well known as Pulse bowl of Karnataka, having 308 registered dal mill units in the district operating at various capacities. Dal mill workers in mills are exposed to dal dust linked with several occupational health hazards. Therefore, the present study was conducted to assess occupational health hazards faced by dal mill workers in dal mill industries. Results of the study showed that majority of the workers expressed that they had one or the other occupational hazards due to the exposure to dal dust. More than half of the workers expressed that they had musculoskeletal problems like body ache (66.70 %), back ache (50.0 %), shoulder ache (53.33 %), pain in the hand about (56.67 %) and more than fifty per cent respondents expressed that they had respiratory related problems like coughing and sneezing (63.33 %) followed by breathlessness (46.67 %), watery nose (60.0 %). Some workers also expressed that they had problems like skin allergies about (56.67 %) burning section of skin (63.33 %). Majority of the workers also expressed that they had eye irritation these occupational hazards among mill workers might be attributed to the prolonged exposure to the dal dust and moreover the workers in the milling area while working was not using any protective measures during milling activities. About 58 per cent of the

workers were not using any protective measures in any milling activities. Less number of workers were using hand kerchiefs and towels as protective measures. Therefore, it is necessary to protect workers' health from occupation hazards in milling environment by creating awareness on use of safety measures that is personal protective equipment's (PPEs), dust reduction and also through health and nutritional awareness programmes.

Key words- Dal mill, Dal dust, Health, Mill workers and Occupational hazards

GENDER GAP ANALYSIS IN AGRICULTURAL AND ALLIED SECTOR

Ipsita Maharana

Centurion University of Technology and Management, Paralakhemundi, Odisha, India-761211

Email: ipsitamaharana6@gmail.com

Abstract

As everybody knows from starting to current situation men are raising their upper hand in such a way women are not permitted to do any of work. In India these types of things happened in earlier ages but now very equal importance is given to women from both men and government side whatever work it may be either household or outside (business, job, marketing, etc.) but, in few countries till now also men hands are higher in this case both government authority, or when it comes to husband and wife or men and women all were thinking women are restricted only to the household purpose. A husband also thinks in such a way that women should be permitted to the house only for cooking and taking care of family members and children. A part from job they are not even allowing to buy at least provision for everything men there is no support from government side also, if the moto will change like women are also permitted to do any activity equal to men this bring equality and gain, there will be no gender gap discrimination.

Theme 5: Crop Improvement

Differential approaches for Crop improvement in response to salinity stress

Annu Luhach1, Nita Lakra1

1Department of Molecular biology, Biotechnology and Bioinformatics, COBSH, CCS Haryana Agricultural University, Hisar 125004, India

Email: annuluhach124@gmail.com

Abstract

Agriculture is the best foundation for human livelihoods, and, in this respect, crop production has been forced to adopt sustainable farming practices. However, soil salinity severely affects crop growth, the degradation of soil quality, and fertility in many countries of the world. Soil salinity is one of the abiotic constraints in many areas of the world due to increasing use of poor quality of water for irrigation and soil salinization. Salinity effect the plant in many ways like imbalance in nutrient acquisition, hampers plant growth followed by arrest of physiological and biochemical processes and, ultimately, death. According to an estimate of FAO, over 6% of the world's land is affected by salinity and sodicity. Land under salinity stress is increasing on daily basis and it is thought that about half of the fertile land would become saline by the year 2050. The effects of salinity are highly diverse and depend on large number of factors like amount, intensity and duration of salinity and crop growth stages. Plant adaptation or tolerance to salinity stress involves complex physiological traits, metabolic pathways, and molecular or gene networks. In general, there are two main approaches for relieving the adverse effects of salinity: (1) development of salt-tolerant transgenic cultivars and (2) improved agricultural practices. Now the use of proteomics and metabolomics-based metabolite markers can serve as an efficient selection tool as a substitute for phenotype-based selection. This study covers the physiological and molecular mechanisms for salinity stress tolerance, recent progress in mapping and introgressing major gene/QTL (genomics), transcriptomics, proteomics, and metabolomics approaches.

Key words- QTL, FAO, Salinitization, Acquisition, Adaptation, metabolic pathways, phenotype, transcriptomics, proteomics, and metabolomics

Diversity of pre emergent weedicides and its impact of dry weight on weeds

*__Aravind Rathod__, and __C.K.Venugopal__

Msc Horticulture, University of Agricultural Sciences, Dharwad

Corresponding email: arvindr4625@gmail.com

Abstract

Studies were carried on diversity of weeds and its dry weight on tuberose in UAS, Dharwad during the year 2013. At 30 DAP, weedy check recorded significantly higher weed dry weight (25.06 g) which was on par with Pyrithiobac 10 EC @ 62.5 g a.i/ha (14.66 g) whereas, Pendimathalin 30 EC @ 1 kg a.i/ha recorded the lowest dry weight of weeds (6.46 g) followed by alachlor 50 EC @ 1.5 kg a.i/ha (8.53 g) and weed free check recorded superiorly lowest (1.76 g) weed dry weight. At 60 DAP, Pendimathalin 30 EC @ 1 kg a.i/ha recorded lowest weed dry weight (5.66 g) followed by Alachlor 50 EC @ 1.5 kg a.i/ha (7.73 g) compared to rest of the treatments which were on par and weed free check again recorded lowest (1.20 g) except weedy check treatment (31.43 g). The treatment Pendimathalin 30 EC @ 1 kg a.i/ha At 90 DAP, recorded significantly lowest weed dry weight (6.46 g) followed by Alachlor 50 EC @ 1.5 kg a.i/ha (9.01 g) which was on par with rest of the treatments, except weedy check (35.56 g). The data showed that At 120 DAP, Pendimathalin 30 EC @ 1 kg a.i/ha recorded significantly lowest weed dry weight of (5.66 g) followed by Alachlor 50 EC @ 1.5 kg a.i/ha (7.63 g) which was significantly superior with weed free check (1.00 g) and was on par with rest of the treatments, except weedy check (36.13g).

DEVELOPMENT OF DROUGHT RESISTANCE RICE VARIETIES IN INDIA

SERI SUBBA SANTOSH

Centurion University of Technology and Management, Paralakhemundi, Odisha, India-761211

Email: 200805210003@cutm.ac.in

Abstract

With the change in the global scenario, drought is becoming one of the major problems among other stress and its effect is more severe in rice whose life cycle completely depends on water. Whether it occurs during any stage (early, intermittent or late) it affects the crop and its effect is more severe when this stress coincides with the reproductive stage of the crop growth. However, rice responds to it by sending signals to shoot which generates signals in terms of physical, chemical, and biological form. Drought is the most widespread and damaging of all environmental stresses, affecting 23 million hectares of rainfed rice in South and Southeast Asia. In some states in India, severe drought can cause as much as 40% yield loss, amounting to $800 million. Hence, screening plants at this stage is most effective for the development of drought resistance. Several drought-resistant traits have been categorized into primary traits, secondary traits, integrative traits, phenology, and plant-type traits. Hence these traits are focused on the development of drought resistance by adopting conventional and molecular strategies. Varieties like IR-36, IR-64 have been released but through conventional breeding, it requires a lot of time to release a variety. Drought-tolerant varieties which have been released in several countries and are now being planted by farmers. These include *Sahbhagi Dhan* in India. Hence molecular strategy has been adopted and focus was given on adopting QTL introgression. QTLs like qDTY1.1, qDTY12.1 have a pronounced effect on yield potential during drought stress. Some of the cases have been also reported that when a combination of several QTLs used then it showed a more pronounced effect during drought stress.

Comparative analysis of nutritional quality in landraces of Assam under organic and inorganic method of cultivation

Lonishree Dutta

Assam Agricultural University, Jorhat, Assam

Email: lonishree.dutta.adj19@aau.ac.in

Abstract

From a collection of 10 rice varieties collected from area under organic cultivation practice for more than 10 years an experiment was laid in Assam Agricultural University, Jorhat, Assam. The experiment was done to observe traits suitable for varietal development under organic situation. By analysis of variance of nine grain character and eight biochemical characters, it was found that there were variations of character in the varieties. The pooled analysis indicated high G x E interaction for most of the characters under investigation indicating necessity for selection of the characters separately for both organic and inorganic situations. In pooled analysis of variance, it was also found high G x E interaction for Fe (Iron) and Zn (Zinc), which indicated that for these two important micro-nutrients selection, will be effective under organic situation. It is concluded from the experiment that variability exist for characters in the indigenous varieties for organic situation and breeding program has to be taken separately for organic situation through selection.

Weed population of monocot weeds and its effect on growth and other parameters of Tuberose

*__Aravind Rathod__, and __C.K.Venugopal__

Msc Horticulture, University of Agricultural Sciences, Dharwad

Corresponding email: arvindr4625@gmail.com

Abstract

Studies were carried on in UAS, Dharwad during the year 2016 on Monocot weeds per 0.25 m^2. The weedy check recorded significantly higher weed count at all the stages of crop

growth in weeds like Grasses (29.67), Sedges (27.67) and Broad leaved (25.00) at 30 DAP, Grasses (30.00), Sedges (24.33) and Broad leaved (28.67) at 60 DAP, Grasses (33.33), Sedges (28.00) and Broad leaved (29.67) at 90 DAP, and Grasses (36.00), Sedges (30.00), Broad leaved (33.67) at 120 DAP, respectively. Weed free check had the lowest weed count at all the stages. Whereas at 30 DAP, all the treatments recorded lower weed count. At 60 DAP Pendimethalin 30 EC @ 1 kg a.i/ ha recorded significantly lower weed count Grasses (6.67), sedges (4.67), Broad leaved (4.67) and was on par with Alachlor 50EC @ 1.5 kg a.i/ ha. Grasses (7.33), Sedges (5.33) and Broad leaved (6.00), At 90 DAP Pendimethalin 30 EC @ 1 kg a.i/ ha recorded significantly lowest Grasses (12.00) Sedges (4.00) and Broad leaved (6.00) weed count was on par with Alachlor 50EC @ 1.5 kg a.i/ ha Grasses (13.00), Sedges (4.67) and Broad leaved (6.67). At 120 DAP, Pendimethalin 30 EC @ 1kg a.i/ ha again recorded significantly the lowest Grasses (10.00), Sedges (3.33) and Broad leaved (5.22) weeds and was on par with rest of the treatments except weedy check. Grasses (36.00), Sedges (30.00) and Broad leaved (33.67) and weed free check treatment superiorly recorded lesser weed count Grasses (2.07), Sedges (1.13) and Broad leaved (2.48) respectively.

Studies on genetic variability, heritability and genetic advance for yield and yield attributes in Cowpea [*Vigna unguiculata* (L.) Walp.] genotypes

Manjulapur Sampath Reddy, Dr. J. P. Singh, Dr. Dhirendra singh

College of Agriculture, Govind Ballabh Pant University of Agriculture and Technology, Pantnagar (Uttarakhand)

Email: manjulapursampathreddy@gmail.com; mobile: +91 8500550700

Abstract

The experiment was conducted using simple randomized block design with three replications and the trail was totally consisted of sixty-nine genotypes. Data on green pod yield per hectare and other Horticultural traits were used to estimate the genetic variability parameters, heritability and genetic advance (GA). Analysis of variance revealed highly significant and significant difference for all studied traits. Evaluated characters were exhibited different levels of variability, heritability and genetic advance among the studied

genotypes. Low to high phenotypic coefficient of variation (PCV) and genotypic coefficient of variation (GCV) were recorded. The highest GCV and PVC values were found particularly for plant height (552.71% and 53.45%), number of pods per plant (36.20% and 36.81%), green pod weight (34.58% and 35.82%) and green pod yield per hectare for GCV (34.29%) and (35.72%) for PCV for number of pods per plot respectively, whereas low GCV and PCV (10.14% and 11.43% respectively) manifested for days to first pod maturity. The highest broad sense heritability value manifested for green pod yield per plant and per plot (98.5%) followed by green pod yield per hectare (98.3%) and plant height (97.2%) while lowest heritability (37.8%) revealed only for number of pods per cluster. In present study low to moderate genetic advance were manifested and high heritability and genetic advance as percentage of mean (>50) was recorded for plant height, pod length, number of seeds per plant, number of pods per plant, number of pods per plot, green pod weight, green pod yield per plant, green pod yield per plot and green pod yield per hectare, indicating predominance of additive gene action for these characters. Therefore, the result of this study suggests existence of variability for green pod yield and other horticultural traits in these cowpea genotypes, which should be exploited in future breeding.

Key words: Variability, heritability, RBD, PCV, GCV, genetic advance.

Effect of chemical priming on inducing drought tolerance to rice variety CAU-R1

Thoudam Anupama Devi

Department of Agronomy, College of Agriculture, Central Agricultural University, Imphal-795004, Manipur

Corresponding author email: anupamathoudam1234@gmail.com

Abstract

Reduced moisture availability at sowing and early seedling establishment stage seriously affects seed germination, growth, and production of rainfed rice. Seed priming is currently a wide used alternate process that accelerates the germination rate and improves seedling uniformity in several crops under moisture stress condition. A pot experiment was

conducted to investigate the effect of chemical priming of seeds on inducing drought tolerance to rice variety CAU-R1 during *kharif* season of 2019 at poly house of College of Agriculture, Central Agricultural University, Imphal. The experiment was laid out in Completely Randomized Design (CRD) with four replications and six treatments. Seeds were soaked in 1 % and 2 % solutions of KNO_3, $CaCl_2$, 40 ppm and 50 ppm of salicylic acid for 12 hours. Rice plants were induced to drought by applying mannitol solution (100mM) at 10 days after emergence (DAE) of seedlings. The results revealed that seeds primed with 2 % KNO_3 showed the lowest days to 50 % germination and mean emergence time, maximum number of seedling leave, seedling height, root length, and root biomass. The treatment of 2% KNO_3 followed by 50 ppm salicylic acid were found to be superior among other treatments in most of the parameters. Therefore, this study concludes that chemical priming of seeds with 2 % KNO_3 had significant influence on germination and all the growth parameters of rice seedlings and can be employed for better crop growth of rice.

Key words- Chemical priming, 2 % KNO_3, mannitol, rice seedlings.

Breeder's Next Generation Approaches for Climate Resilient Ready Crops

Rajneesh Kumar1*, Smita Kumari2, Pravin L Chaudhry3

[1,3]Department of Genetics and Plant Breeding, School of Agriculture
[2]Department of Agronomy, School of Agriculture, Lovely Professional University, Phagwara-144411, Punjab, India.

Corresponding author: r4rajneesh1997@gmail.com

Abstract

In this review, we mark out the next-generation breeder's approaches that can be utilize to develop superior genotypes which encounter with the future challenges of food security and resilient to changing climates. The IPCC report also said that the impact of climate crisis, like changing pattern of monsoon, rising level of the sea, deadlier heat waves, intense storms and global warming will impose a risk to the agriculture sector. And with a growing global population and global warming which declines the food production, melting glaciers

cause flooding and soil erosion. Plant breeders had always took part and play a crucial role in history by revolutionizing Agri. Sector to overcome starvation for ever-growing population. By make use of genetic diversities and extensive use of wild germplasm is critical for every crop improvement program. Accordingly, National Innovations in Climate Resilient Agriculture (NICRA) was launched in 2011 under ICAR. Our Honorable Prime Minister Narendra Modi dedicated 35 crop varieties with special traits to the nation for the adoption of climate-resilient technologies and successfully edit the major crop to develop resistance against abiotic and biotic stress. Early & drought-tolerant cultivars of green gram (BM 2002-1), drought-tolerant chickpea and pigeon pea (BDN-708), sorghum (CSH-14) and early maturing cultivars of pigeon pea (AKT-8811), wilt and sterility mosaic resistant pigeon pea, early maturing variety of soybean, disease resistant varieties of rice and biofortified varieties of wheat, pearl millet, maize and chickpea. Smart breeding approaches can be auspicious way to tackle out the climate mitigation and develop better-Climate Resilient crop varieties. Recent innovations in breeding techniques based upon genomic-assisted breeding (GAB) strategies allow to construct a new platform to make use of these genetic variation for optimizing crosses. In addition, the integration of next-generation multidisciplinary breeding techniques may strengthen development of climate-ready crops.

Key words- Mitigation, Climate-resilient, Breeding, Biofortified, Biotic & Abiotic

UNDERSTANDING THE MOLECULAR MECHANISMS OF HETEROSIS IN PLANTS

Niranjan Kumar Chaurasia*, Praveen Kumar[1] and Porinita Bora[2]

Department of Genetics and Plant Breeding, Centurion University of Technology and Management, Odisha, India-761211

[1]Department of Genetics and Plant Breeding, Mandsour University, Madhya Pradesh, India-458002

[2]Department of Plant Breeding and Genetics, Assam Agricultural University, Jorhat, India- 785013

Email: nirajan684@gmail.com

Abstract

Heterosis or hybrid vigour, is a phenomenon that defines a hybrid offspring's survival and performance superiority to the average of both of its genetically separate parents. In the last 100 years, plentiful studies have been led to better understand the genetic foundation of heterosis, but knowledge of the underlying molecular processes that lead to hybrid vigour remains unclear. Current advancement in study hybrids and allopolyploid by means of functional genomics, transcriptomics, proteomics, metabolomics, and epigenomics linked technologies, the riddle of heterosis is being reinvestigated by adopting system level methods to understand the underlying molecular mechanisms. A number of intriguing ideas have been proposed, including the idea of a cumulative beneficial influence of differently expressed genes on one or several yields altering metabolic pathways or overall energy usage efficiency as the underlying mechanism for heterosis/hybrid vigour expression. Serial analysis of gene expression (SAGE) revealed 1183 differentially expressed genes (DGs) in F_1 super-hybrid rice, Liangyou-2186 and their parents (SE21s and MH86), with DGs significantly enriched in pathways such as photosynthesis and carbon-fixation, and most of the important genes involved in the carbon-fixation pathway exhibiting up-regulated expression in F_1 hybrid rice. Comparative proteomic profiles of young primary roots and growth parameters of the UENF/UEM01 popcorn hybrid advised that heterosis in the popcorn hybrid at an early stage of plant development is linked with an up-regulation of proteins involved in synthesis and energy metabolism. Individual genes, regulatory components, and their related networks are genetically and epigenetically reprogrammed to increase growth, stress tolerance, and fitness in hybrids. The energy-use-efficiency

model show hybrids have more efficient growth than inbreds because of significant reduction in the energy consumption processes of protein metabolism. Hence understanding the molecular mechanisms of heterosis help us to identify the molecular keys to switch ON/OFF metabolic and growth vigour at different developmental stages of plant.

Key words- Genetic model of heterosis, Heterosis/hybrid vigour, Molecular mechanisms of heterosis

SMART breeding: A way to achieve climate smart agriculture

Vani Praveena M[1]., Palaparthi Dharmateja[2] and M. Hemakumar Reddy[3]

1. Ph.D. Scholar, Genetics and Plant Breeding, ANGRAU, Agricultural College, Bapatla
2. Ph.D. Scholar, Genetics and Plant Breeding, IARI, New Delhi
3. Ph.D. Scholar, Genetics and Plant Breeding, BCKV, West Bengal.

Abstract

Breeding crop plants with increased yield potential and improved tolerance to changing climatic conditions is critical to achieve global food security in the era of ongoing and expected climate change throughout the planet. Improved plant types that can tolerate diseases and pests with high resource use efficiency and yields in a stressful climate might only assist to realise the objective of climate resilient agriculture in the near future. To address crop plant vulnerabilities to climatic changes, smart breeding relies heavily on large breeding populations, efficient high throughput phenotyping, big data management technologies, and downstream molecular approaches. Smart breeding is a concept that combines traditional breeding tactics with new molecular, genomic, and phenomic technologies to efficiently and effectively develop crop cultivars with increased yield potential. In SMART breeding approach classical plant breeding methods like crossing of distantly related plants followed by selection of superior combinations is combined with novel molecular tools. Smart breeding uses gene mapping and mutagenesis to characterize plants with desirable traits followed by tissue culturing and subsequent regeneration of selected plants, thus essentially reduce the steps among classical crossbreeding which include selection of desirable breeding results and subsequent propagation. Thus, the acronym of SMART stands for selection with markers and advanced reproductive

techniques. Climate smart breeding also necessitates the efficient preservation and protection of plant genetic resources. Methods like gene editing directly transfer novel alleles discovered in wild plants into domesticated crop varieties could be used to capture unique variety. With more knowledge of their basic physiological and genetic mechanisms, new crop cultivars with can be developed. The biotechnological and digital revolution, as well as advancements in phenotypic and genotypic analysis, and tissue culture techniques could pave the way for the development and deployment of climate smart cultivars in the future using SMART breeding.

Genetic intervention for improving phosphorus use efficiency in wheat (*Triticum aestivum* L.)

Palaparthi Dharmateja[1], M. Hemakumar Reddy[2], Vani Praveena M[3] and Indraja G[4]

[1]Ph.D. Scholar, Division of Genetics, ICAR Indian Agricultural Research Institute, New Delhi.

[2]Ph.D. Scholar, Department of Genetics and Plant Breeding, BCKV, West Bengal.

[3]Ph.D. Scholar, Department of Genetics and Plant Breeding, College of Agriculture, ANGRAU, Bapatla.

[4]Ph.D. Scholar, Department of Vegetable Science, Dr.Y.S.R.H.U, Venkataramannagudem, A.P.

Abstract

Phosphorus (P) is one of the essential and indispensable nutrients for plant growth and development. Phosphorus is a key mineral element necessary for plant growth, plays an important role in energy metabolism, sugar metabolism, enzymatic reaction and photosynthesis. P cannot be substituted by any other element. Phosphorus is also a component of nucleic acid, plant hormone and lecithin, and it determines the yield and quality of crops to a large extent. The primary source of phosphorus fertilizer is rock phosphate, which is a non-renewable resource and is expected to become scarce in the future. A few mining sites are discovered and demand is expected to increase further by 50–100% in the next 30 years. USA and China have presently stopped the export of phosphorus fertilizer due to expected future scarcity. In contrast to nitrogen that can be fixed from the atmosphere, the amount of phosphorus available for agriculture is finite. P

is considered one of the important yield-limiting factors in the context of sustainable agricultural production systems in subtropical and tropical conditions. P utilization rate is low (10.7%) in wheat compared to rice (13.1%) and maize (11%), which has demanded the immediate attention of wheat researchers across the globe. In India, 49.3% of soil has a low P, 48.8% is of average P and only about 1.9% are in the high P category. In this context, genetic interventions are compulsory and need of the hour for breeding P use efficient crops. This is very much essential to make sure of increased productivity and to meet the current food demand, but in ways that are environmentally safe, economically viable, and socially sustainable. More P efficient cultivars can either reduce P applications or reduce the environmental risk associated with the high P use in agriculture.

Key words- Phosphorus, Wheat, Environment and Nutrients

Pyramiding of Stripe rust and Leaf rust Resistance with High Molecular Weight Gluten Strength (*HMW-GS*) in Bread Wheat (*Triticum aestivum* L.)

Himanshu Chaudhary* and J.P. Jaiswal

Department of Genetics & Plant Breeding, College of Agriculture
G B Pant University of Agriculture & Technology, Pantnagar, U.K., India-263145

***Corresponding author Email**: himanshugenetics2513@gmail.com*

Abstract

Bread wheat is the most important staple food crop of the world. Being a crop of global significance, it is grown in a wide range of climatic environments and geographic regions. It is a major source of energy, protein and dietary fiber in human nutrition. With climate change, the wheat crop is facing multiple threats due to biotic and abiotic stresses resulting in significant yield loss. Among the biotic stresses, the rust diseases are known to cause significant losses to wheat yield worldwide. Malnutrition, famine, and lack of food security are significant issues throughout the world. Therefore, this necessitates the development of rust resistant high yielding varieties against ever-evolving virulent races of rusts along with the improvement in the nutritional quality. *HMW-GS* is important in determining the

quality and the end use properties of the dough. Marker Assisted Selection (MAS) is being successfully implemented to introgress and pyramid genes/QTLs for different traits in wheat. The donor K9107 was used to transfer HMW-GS gene and transfer of this gene was confirmed using the marker Dx5. Simultaneously donor Avocet/Yr15 and FLW 8 were used to transfer one each stripe rust gene, Yr15 and leaf rust resistance, Lr19 and the transfer of both genes was confirmed by gene specific molecular markers, Xgwm273 and Wmc221, respectively. Later, HMW-GS and both the rust genes were pyramided in the background of UP 2338 using the molecular markers. Foreground selection was done to ensure the presence of selected genes in the upcoming generations. Rigorous phenotypic selection was exercised to ensure the recovery of phenotype of the recurrent parent, UP 2338. It is envisaged that improved lines in the background of UP 2338 will act as donor for the transfer of multiple genes in the future wheat breeding programme.

Key words- Wheat, Rust, *HMW-GS*, marker assisted selection, marker assisted pyramiding.

Role of high throughput Phenotyping technologies to sustainable crop production

M. Hemakumar Reddy[1] Palaparthi Dharmateja[2] and Vani Praveena M[3]

1. Ph.D. Scholar, Genetics and Plant Breeding, BCKV, West Bengal
2. Ph.D. Scholar, Genetics and Plant Breeding, IARI, New Delhi
3. Ph.D. Scholar, Genetics and Plant Breeding, ANGRAU, Agricultural College, Bapatla

Abstract

The world population growing at faster rates than the crop yields. The major concern is that to increase crop yields so that we meet the needs of growing population. Even though whole-genome sequencing of many crops has been achieved, crop functional genomics studies have stepped into the big-data and high-throughput era. However, acquisition of large-scale phenotypic data has become one of the major bottlenecks hindering crop breeding and functional genomics studies. The selection of high yielding and stress-tolerant plants is necessary to ensure that crop production keeps pace with population growth. By

establishing the connection between genotype and phenotype, it is possible to improve agricultural production to satisfy the requirement of the growing human population. Therefore, phenotyping is as important as genotyping in establishing the relationship between genes and traits. Indeed, phenotyping is rapidly becoming the major operational bottleneck in limiting the power of genetic analysis and genomic prediction. With increasing demand to support and accelerate progress in breeding for novel traits, the plant research community faces the need to accurately measure increasingly large numbers of plants and plant parameters. With High throughput phenotyping technologies, we can phenotype large population in considerably less time. Although there is considerable progress achieved in high throughput phenotyping technologies, still there is room for development and innovation.

Studies on crop toxicity ratings of pre-emergent herbicides on Tuberose

*__Aravind Rathod__, and __C.K. Venugopal__

M.sc. Horticulture, University of Agricultural Sciences, Dharwad

Corresponding email: arvindr4625@gmail.com

Abstract

Pre-emergent herbicides were applied day after planting (DAA) and observed crop toxicity rating at 1, 3, 5, 7 and 14 Days. At one and three days after application crop toxicity was not observed plant treated with pre-emergent herbicides. Visual observations on crop toxicity rating recorded at 5, 7 and 14 DAA of post emergent herbicides At 5, 7 and 14 DAA, post-emergence application of Oxyfluorfen 23.5 EC @ 75 g a.i. / ha (POE) caused toxicity to the crop which recorded the crop toxicity rating of 2.33, 3.00 and 2.00, respectively. This treatment was closely followed by Imazethapyr 10 SL @ 75 g a.i /ha which recorded 1.66, 2.00 and 1.66 ratings, respectively. And Pyrithiobac 10 EC @ 62.5 g a.i /ha, 1.33, 2.33, and 1.33 ratings were observed respectively. Other herbicides did not show any injury to the crops.

Characterization of oat (*Avena sativa* L.) genotypes to study genetic variability through multiple marker system approach

Rukoo chawla, Minakshi Jattan and D. S. Phogat

MPUAT, Udaipur, Rajasthan, India

Abstract

Oat (*Avena sativa* L.) is an important fodder and cereal crop. It significantly contributes to agricultural output to achieve food and nutritional security. The presence of variability is vital for hybridization and crop enhancement projects. DNA-based markers are useful predictors of genetic distances across accessions since they are neutral in the face of selection. Molecular markers are an important tool in plant breeding for genetic research of crops since they aid in discovering and analysing genetic variation and identifying cultivar identity. In the present study, 50 markers were tested, and 29 of them were shown to be polymorphic. R Studio was used for the data analysis. Out of 29 markers, 13 were CBDP and 8 were SSR & SCAR markers each. The current work underlines the use of multiple marker systems to assess genetic diversity. The average PIC value observed for CBDP, SCAR and SSR markers was 0.70, 0.32 and 0.53 respectively. To demonstrate the discriminating capacity of the markers, several parameters such as PIC value, Expected Heterozygosity, Marker Index, Effective Multiplex Ratio, and Resolving Power were computed. On the positive side, the Mantel test demonstrated a low but significant link between SCAR markers dissimilarity matrix and 17 examined morphological and qualitative traits dissimilarity matrix, indicating agreement with a genetic relationship. CBDP markers were shown to have high polymorphism and resolving power among the other markers employed. The results demonstrated significant similarities between the (morphological and quality matrix) and the CBDP matrix, with the same set of genotypes having the lowest dissimilarity coefficient in both matrices. Breeders can use the information gained from genetic diversity research to devise effective techniques and tactics for future crop improvement and the selection of basic material for hybridization programmes.

SPEED BREEDING, THE TECHNIQUE FOR CROP IMPROVEMENT

Joshna Angom, Sanghamitra Rout[2], Vinay Kumar[2] and Krishnam Raju[3]

M. Sc Research Scholar of M.S. Swaminathan School of Agriculture in Centurion University of Technology and Management

[2]Assistant Professor in Genetics and Plant Breeding of M.S. Swaminathan School of Agriculture in Centurion University of Technology and Management

[3]Associate Professor in Genetics and Plant Breeding of M.S. Swaminathan School of Agriculture in Centurion University of Technology and Management

Email: joshnaangom20@gmail.com

Abstract

Speed Breeding is a new technique originally inspired by the US National Aeronautics and Space Administration (NASA). This technique helps in the improvement and development of new crop varieties faster. The technology aims at developing the variety through continuous light for about 20-22 hours. The technique allows the plants to photosynthesis for longer, resulting its faster growth. Speed Breeding helps to increase the production of the crop. With the increasing population size, improvement in the production of crop is needed. This method is also known as accelerated plant breeding. In this technique the plants are grown in controlled growth chambers or greenhouse using optimal light intensity and quality, particular day length and temperature, which accelerates the physiological processes in plants like photosynthesis and flowering etc. The most appropriate selection methods amenable with speed breeding are single seed descent (SSD), single pod descent (SPD), single plant selection (SPS). Speed Breeding needs manipulation of various condition like manipulation of photoperiod regime. Different plants have variable photoperiod requirement for flower induction and seed set. Thus, it is important to give that optimum period for induction of seed and fruit. Not only in photoperiod but also temperature and soil moisture are also important. Adjustment of temperature and soil moisture according to that particular crop improves in the growth, flowering, seed set and maturity. Thus, speed breeding is the most adoptive technique for the development of new varieties without time consuming.

Key word- Aeronautics, Accelerated, Descent, Photoperiod

GENETIC ESTIMATES AND GENE ACTION FOR OBTAINING PROMISING HETEROTIC HYBRIDS IN BOTTLE GOURD

Rajendra Bhatt and Manoj Raghav

Department of Vegetable Science, College of Agriculture, GBPUA&T, Pantnagar-263145, US Nagar, Uttarakhand

Email: 52497_rajendrabhatt@gbpuat-tech.ac.in

Abstract

The experiment was conducted at Vegetable Research Centre, GBPUA&T, Pantnagar, US Nagar (Uttarakhand) during the summer season of 2020 and 2021. Gene action, magnitude of exploitable heterosis and combining ability variance and its effects were studied through half diallel analysis including twenty-eight F1 hybrids derived by crossing eight diverse bottle gourd parents for earliness and yield components. Data was recorded for twelve quantitative traits including 5 maturity traits for earliness. Ratio of GCA and SCA variance revealed preponderance of non- additive genetic variance for all studied traits except fruit length. The genetic ratio H2/4H1 revealed that the asymmetrical distribution of the positive and negative alleles at all loci for most of the traits. All traits exhibit below 50 per cent narrow sense heritability except fruit length (72%). The average degree of dominance (H1/D)1/2 revealed that over dominance gene action for most of the yield related traits except fruit length. The best performing F1 hybrids regarding earliness, standard heterosis, SCA effects and mean performance of crosses were found in crosses L-11 x L-2, L-11 x L-5 and L-3 x L-10. Based on earliness, desirable fruit shape and high fruit yield, elite hybrids were L-4 x L-2, L-7 x L-2, L-3 x L-4.

Key words- Bottle Gourd, Combining Ability, Dominance, Earliness, Heterosis, Narrow sense.

BREEDING FOR OIL QUALITY IN LINSEED

Shatrudhan Kumar Choudhary*, Surpati Anand, Sourabh Kumar, Cheguri Prathyusha

Department of Plant Breeding and Genetics, Bihar Agricultural University, Sabour, Bhagalpur- 813210

***Corresponding author**: 06shatrudhandkac@gmail.com

Abstract

Linseed (*Linum usitatissimum* L., 2n = 30) commonly known as flax or flaxseed, is a predominantly self-pollinated oilseed crop cultivated for thousand years mainly for its seed oil and high quality stem fibre. Its oil contains 16-24% oleic acid, 18-24% linoleic acid and 36-50% linolenic acid with a relatively low glucosinolate content. Linseed cultivars are rich in omega-3 (alpha linolenic acid) fatty acids which is functionally associated with several positive health benefits. Alpha linolenic acid is an essential fatty acid acts as a precursor for biologically active longer chain polyunsaturated fatty acids of omega-3 class, mainly the Eicosapentaeonic acid and Docosahexaeonic acid. In future, it is forecasted that there will be a high demand for linseed oil for medicinal purpose. Despite of different health benefits, its oil is not used for cooking due to occurrence of rancidity in the oil after storage. The rancidity occurs because of oxidation of the oil. However, efforts are going on to lowering the linolenic acid content in the oil to make linseed oil 'premium' cooking oil. It also increases the amount of other unsaturated fatty acids in the oil. The major developments in the field of linseed improvement in the recent past moving from the conventional approaches like selection, hybridization and mutation for improving oil yield and quality to the new approaches like MAS and other biotechnical tools. Further, we can improve the quality of linseed oil using combination of conventional and advanced breeding technics.

Key words- Alfa linolenic acid, Linseed, Oil quality, Polyunsaturated fatty acid

Studies on genetic variability, heritability and genetic advance for yield and yield attributes in Bittergourd (*Momordica charantia* L.) genotypes

Manjulapur Sampath Reddy[1], P. Prashanth[2], D. Laxminarayana[3], P. Saidaiah[4]

College of Horticulture, Mojerla, Sri Konda Laxman Telangana State Horticultural University, Hyderabad (Telangana)

Email: manjulapursampathreddy@gmail.com; mobile: +91 8500550700

Abstract

The present investigation was undertaken during *Kharif* 2017-18, College of Horticulture, Mojerla, Sri Konda Laxman Telangana State Horticultural University, Telangana. The trial was laid out in Randomized Block Design with twenty-seven bitter gourd genotypes. Analysis of variance revealed significant differences among all the genotypes for all the characters. The genetic parameters were studied to elucidate the genetic variability, heritability and genetic advance in bitter gourd (*Momordica charantia* L.). The genotypes exhibited a large range of variability for all the characters. Phenotypic coefficient of variation (PCV) was more than genotypic coefficient of variation (GCV) for all the characters studied. PCV was higher than the appropriate GCV in all aspects that describe the environmental factors that influence their expression to some degree or another. Heritability (> 60) have been observed for vine length, number of primary branches per vine, number of nodes per vine, Internodal length, Days to first male flower appearance, Days to first female flower appearance, Nodes at which first male flower appearance, Nodes at which first female flower appearance, Number of fruits per vine, average fruit weight, fruit length, fruit diameter, number of seeds per fruit, 100 seed weight, total fruit yield per vine and fruit fly infestation per cent. Genetic advance, *i.e*., genetic gain, ranged from 0.91 to 108.80. High genetic gain (> 20%) was observed for vine length and days to last fruit harvest. High heritability combined with high genetic advance was observed for the characters vine length. High heritability combined with high genetic advance indicates that additive gene action plays a serious role in governing these traits and these traits will be improved by simple selection.

Key words- Variability, heritability, RBD, PCV, GCV, genetic advance.

Assessment of genetic diversity using D^2 statistics in chickpea genotypes (*Cicer arietinum* L.) under late sown conditions of Dehradun

KESHAV JAMWAL*, GIDEON SYNREM and SHARAD PANDEY*****

*M.Sc (Ag.) Genetics & Plant Breeding,

** Assistant Professor-Genetics & Plant Breeding,

***Dean, School of Agriculture, Forestry and Fisheries

Department of Agriculture, (Genetics and Plant Breeding)

Himgiri Zee University, P.O. Sherpur, Chakrata Road, Dehradun-248197 Uttarakhand

Corresponding email id: 2602.keshav@gmail.com

Abstract

An experiment using twenty eight genotypes of chickpea (*Cicer arietinum* L.) was conducted during Rabi season of 2020-21, to find the genetic diversity among them using D^2 statistics by P.C. Mahalanobis. The experiment was laid out in randomized block design with three replications. The plot size was three meters with two rows of chickpea sown at a distance of 45 centimetres on 20th November 2020, at the experimental field of Himgiri Zee University, Dehradun. The observations were recorded on fifteen quantitative characters viz., days to emergence, days to 50% flowering, days to 100 % maturity, grain filling period, plant height, number of primary branches, number of secondary branches, number of pods per plant, number of seeds per pod, size of pods, one hundred seed weight, grain yield per plant, biological yield per plant, harvest index and leaf relative water content in twenty eight diverse genotypes of chickpea, where five randomly selected plants were taken and the average was calculated for the study. The traits days to 50 % flowering and days to 100 % maturity however was taken in plot basis. Results revealed that the genotypes were grouped into 5 clusters where Cluster-I had eleven genotypes, cluster II had fourteen genotypes, cluster-III, cluster-IV and cluster-V showed one genotype each. The grain yield per plant contributed maximum towards genetic diversity (14.02 %) followed by harvest index (14.29 %) and leaf relative water content (6.35 %). The highest grain yield per plant

was recorded by RVG-203 (31.32 g). The analysis of variance showed there is significant difference among the genotypes for fifteen characters under the study.

Key words- Chickpea, Cluster analysis, D2 statistics, Randomized block design, grain yield

Designer Rice for the Quality Traits Improvement

Aaruru Mounika[1], Niranjan Kumar Chaurasia[2*], Pushpalatha G[3]

[1&2]Department of Genetics and Plant Breeding, M.S. Swaminathan School of Agriculture Centurion University of Technology and Management, Odisha

[3]Department of Plant Biotechnology, M.S. Swaminathan School of Agriculture, Centurion University of Technology and Management, Odisha

Email: nirajan684@gmail.com

Abstract

The improvement of grain yield in rice is a major breeding objective that is primarily done by direct selection under field conditions for primary and secondary yield components. To ensure rice food security, the target outputs of future rice breeding programmes should focus on developing climate-resilient rice varieties with emphasis on increased head rice yield coupled with superior grain quality. The newly discovered genes and the knowledge gained on the influence of specific alleles related to stability of grain quality attributes provide a robust platform for marker-assisted selection in breeding to design heat-tolerant rice varieties with superior grain quality. Genetics can help fast-track the identification of novel alleles and gene targets that can be pyramided for the development of environmentally robust rice varieties that possess improved grain quality and rice grain qualities and appearances such as gelatinizing temperature (GT), amylose content (AC),grain protein content (GPC), pericarp colour (PC),length/width ratio (LWR) rice grain qualities and appearances such as gelatinization temperature (GT), amylose content (AC), grain protein content (GPC), pericarp colour (PC), length/width ratio (LWR), and grain volume (GV) at phenotypic and genetic levels, as well as the relationships among them. A genome-wide association study (GWAS) was used to identify the quantitative trait locus (QTLs) associated with the target traits.

Key words- Climate resilient, Marker assisted selection and Novel alleles

Genetic variation in pollen vigor for cold tolerance in chickpea (*Cicer arietinum* L.)

Arvind Chauhan *, Anju Arora, Shreya, Nimita Kandwal and Anupriya Rana

Department of Genetics and Plant Breeding, G.B. Pant University of Agriculture and Technology, Pantnagar, Uttarakhand-263145

***Corresponding author's email:** arvindch1895@gmail.com*

Abstract

Plants respond with changes in their pattern of gene expression and protein products when exposed to low temperatures. Thus, ability to adapt has an impact on the distribution and survival of the plant, and on crop yields. Many crop species are injured or killed by non-freezing low temperatures, and exhibit various symptoms of low temperature injury such as chlorosis, necrosis, or growth retardation in both vegetative and reproductive phases. In contrast, chilling tolerant species are able to grow at such cold temperatures. Chickpea as a *rabi* season crop faces varying degrees of low temperatures periods at different stages of plant growth. Reproductive stage being most sensitive to low temperature as it leads to floral abortion in chickpea cultivars ultimately reduced yield. Observations recorded under invitro conditions showed distinct genetic variation in gamete development (pollen viability) and function (pollen germination and tube growth) under varying degree of low temperatures. The higher pollen vigor (germination and tube growth) and pollen viability at low temperatures of tolerant lines than the sensitive cultivars will lead to greater pod-setting ability. The reduced ovule fertilization can be associated with decline in pollen tube growth and ovule viability, so to be considered as the major cause for poor seed set at low temperatures. The magnitude of effects on pollen function varied with genotypes and severity of stress.

Key words- Chickpea, Genetic variation, cold tolerance, pollen germination.

SUSTAINABLE AGRICULTURE- A STEP TOWARDS 2030 DEVELOPMENT AGENDA

Kanneboina Soujanya[1] (Ph.D scholar), Mudigiri Chandana[2] (Ph.D scholar) and Dr. B. Anila Kumari[1] (Assistant professor)

[1]Dept. of Food and Nutrition, Post Graduate & Research Centre, [2]Dept. Soil Science and Agricultural Chemistry, PJTS Agricultural University, Rajendranagar, Hyderabad (500 030), India

Abstract

Since last two to three decades, the focus has shifted towards sustainability to creates a balance between the economic, environment and social needs. According to projections of FAO, food production has to be increased to 80% by 2050 to meet the demands of the growing population and to support changing dietary patterns. But there is very little scope for the agricultural area expansion. Agriculture is a fundamental human activity that depends intrinsically on natural processes, including soil fertility, water recycling and pollination. But inefficient usage of water, inappropriate usage of fertilizers and pesticides, loss of living resources and biodiversity, climate change, loss of soil organic carbon, pest and diseases pressures, water shortage, decreased soil fertility, increased pesticide residues, food and nutrition security are major problems of the world. Achieving that level of production from an already seriously depleted natural resource base will be impossible without profound changes in our food and agriculture systems. To address all these problems the concept of sustainable food and agriculture in a broader perspective of considering all the factors to achieve healthy growth. Sustainable agricultural development as "the management and conservation of the natural resource base, and the orientation of technological change in such a manner as to ensure the attainment of continued satisfaction of human needs for present and future generations. It conserves land, water, plant and animal genetic resources, diversifies enterprises, manage pests ecologically, maximises biodiversity and is environmentally non-degrading, technically appropriate, economically viable and socially acceptable". Implementation of sustainable policies and practices in decision and responsibility of each Country, partnerships and collaboration will be increasingly important.

Key words- Sustainability, conservation, development, malnutrition, food security

To study the effect of zinc sulphate nanoparticle on the productivity of oyster mushroom (*Pleurotus florida*)

Shivani[1]*, KPS Kushwaha[2] and Aravind. T[3]

[1]Assistant Professor, Plant Pathology, Doon PG College of Agriculture and Technology, Selaqui, Dehradun, Uttarakhand

[2]Professor, Plant Pathology, GB Pant University of Agriculture and Technology, Pantnagar, US Nagar, Uttarakhand

[3]Assistant Professor, Plant Pathology, MSSSoA, Centurion University of Technology and Management, Odisha-761211

***Corresponding author*:** shivanipkgr03@gmail.com

Abstract

Mushrooms have been considered as functional foods since the time immemorial owing to its nutritional and medicinal properties. Similar to the agricultural crops, the biofortification of mushrooms using nanoparticles is an emerging technology in the field of mushroom cultivation. It has been widely adopted to delineate micronutrient deficiencies and increasing biological yield of mushrooms. Among the cultivated mushrooms, oyster mushroom is highly popular as they are rich in nutrients, antioxidants and trace minerals. The present investigation was carried out to at the Mushroom Research and Training Centre, GBPUAT, Pantnagar, to determine the impact of zinc sulphate nanoparticles at four different concentrations *viz.*, 10 to 40 ppm on the biological yield of oyster mushroom. The results revealed that all the tested concentration had significantly higher yield as compared to the control. Among the tested concentrations, 10 ppm concentration significantly increased the total yield and biological efficiency of oyster mushroom. It was followed by 20 ppm, 30 ppm and 40 ppm, respectively. The total yield was 1088.33g, 964.98g, 889.98g and 874.99g in 10, 20, 30 and 40 ppm respectively as compared to 724.98g in control. Similar trend was observed in the biological efficiency as well with the 10ppm concentration having the highest biological efficiency of 108.83 percent which was followed by 20 ppm (96.50%), 30 ppm (89.00%) and 40 ppm (87.50%). The results

obtained in the study can be used for increasing the production of the oyster mushroom in the country as well to decrease the zinc malnutrition.

Key words- Mushroom, *Pleurotus florida*, zinc sulphate nanoparticle, biological yield

MARKER ASSISTED BREEDING IN RICE IMPROVEMENT

Thalari Vasanth Rao[1]*, Cheguri Prathyusha[2]

[1]Assam Agricultural University, Jorhat - 785013 Assam, India.

[2] Bihar Agricultural University, Sabour, Bhagalpur – 813210, Bihar, India

Email: vasanthmosestalari333@gmail.com

Abstract

Rice (*Oryza sativa* L.) is the second most cultivated cereal in the world. Unfortunately, global rice production is rendered by significant number of abiotic and biotic stresses. Conventional breeding methodologies have extensively proven successful in development of rice cultivars and germplasm. However, conventional breeding is still dependent to a considerable extent on subjective evaluation and empirical selection. Scientific breeding needs less subjectiveness and more science, i.e., practical and accurate evaluation, and effective and efficient selection. Marker assisted breeding (MAB) has brought great challenges, opportunities and prospects for conventional breeding. Advances in molecular biology had revolutionized and irreversibly changes in the disciplines of plant genetic and breeding. Integration of DNA-based markers in selection process enhances the effectiveness and accuracy of conventional plant breeding. (Hasan, N.A *et al*., (2020) Marker assisted selection (MAS) refers to the use of DNA markers that are tightly-linked to target loci as a substitute for or to assist phenotypic screening. Marker assisted backcrossing (MABC) is a useful method in rice improvement. Nowadays marker assisted backcross breeding being widely used in plant breeding programmes (Hasan, M *et a*l., (2015). The limitations of conventional breeding such as linkage drag and lengthy time consumption can be overcome by utilizing DNA markers in plant breeding it is possible to recover the recurrent parent genotype using only two or three backcrosses. Gene pyramiding, widely used for combining multiple disease resistance genes for specific races of pathogen, pyramiding is extremely difficult to achieve using conventional methods

(Jamaloddin *et a*l., (2020). Early generation MAS conducted at F_2 or F_3 stage plants with desirable genes/QTLs are selected and alleles can be 'fixed' in the homozygous state. In some cases, a combination of phenotypic screening and MAS approach may be useful to maximize genetic gain (when some QTLs have been unidentified from QTL mapping). Molecular markers are becoming essential components in breeding programs involving gene pyramiding using marker-assisted selection in backcross-breeding program.

Key words- Markers assisted selection, MABC, Gene pyramiding, Early generation MAS, Current applicable molecular markers in rice

ROLE OF GERMPLASM IN CROP IMPROVEMENT OF FRUIT CROPS

Maraboina Sandhyarani[*]Sudati Akshitha[1]

[*]Ph.D. Scholar (Fruit science), Dr. Y. S. R Horticultural university, College of Horticulture, Venkatramannagudem.

[1]Ph.D Scholar (Floriculture and Landscaping Architecture), Sri Konda Laxman Telangana State Horticultural University, Rajendranagar.

Author mail I'd: sandhyamaraboina12@gmail.com

Abstract

Germplasm repositories primarily provide the raw material for plant breeding and crop improvement programs. Germplasm repositories for fruit trees are uniquely constructed as clonal living collections preserved in orchards, vineyards and plantations or nurseries, etc. They include diverse valuable resources such as current commercial cultivars, traditional cultivars, landraces, breeding materials, elite selections and wild relatives. One of the prioritized tasks in a germplasm repository of fruit tress is to characterize the genetic diversity and composition of accessions maintained in the repository to capture a genetic and morphological diversity that is as broad as possible; to facilitate the characterization of intra- and interspecific variation; and to understand phylogenetic relationships among all resources including cultivars, varieties, subspecies and species particularly those between wild relatives. The quantity and quality of data documentation are of crucial importance for any germplasm repository management. Although data documentation has changed

over time with initial morphological evaluation, genomic data have been increasingly obtained from a wide range of fruit tree germplasm collections. Genotyping accessions has become routine protocol in fruit tree germplasm collections to verify pedigrees and track a trait of interest in breeding. Nevertheless, genetic information obtained using SSR, SNP, AmpSeq, etc. provides a valuable resource for breeding designs of fruit trees for both traditional breeding and molecular breeding programs.

Key words- Germplasm, Crop Improvement, Fruit Crops, Wild Relatives.

GIS a tool for Climate-smart management of Plant Genetic Resources

Maruthi RT[1*] and Arroju Anil Kumar[2]

[1]ICAR-Sugarcane Research Institute, Coimbatore-641041, Tamil Nadu.

[2]ICAR-Central Research Institute for Jute and Allied Fibres, Kolkata-700121, West Bengal.

***Email:** maru7806@gmail.com

Abstract

Plant genetic resource are the valuable assets underpins global food security and nutrition. They harbour enormous diversity of heritable traits, which help breeders in developing improved crop varieties to combat the present and future biotic or abiotic threats arising due to climate change and anthropogenic activities. India has a rich and varied heritage of plant biodiversity, encompassing a wide spectrum of natural habitats and is an important centre of origin and diversity for majority plant species of economic importance. However, in the recent past there is a great concern for the genetic erosion in wild gene pool generated by habitat loss due to human activities and climate changes. Several technological interventions were made in the collection and conservation aspects to safeguard plant genetic resource. In the present paper we are discussing the scope and importance of one such technique. 'Geo-referencing' is process where all the passport details and associated morphometric characteristics of germplasm were assigned to geographic coordinates of respective germplasm collection site. GIS allows us to visualize, understand and interpret data in many new ways that reveal patterns and relationships in geographical data. GIS can

be used to increase the efficiency and effectiveness of germplasm conservation. Geo-referencing has several benefits like it helps in locating of trait-specific or crop wild relative site, areas of high diversity index and to identify gaps in collection. It's also useful in identifying possible areas of genetic erosion for taking counter measures. Besides, GIS data coupled with climatic, vegetation and soil data from the previous collection site can be utilized to predict the distribution and phenology of the taxon of interest through modelling. Geo-referencing with the passport/herbarium/National Gene Bank database could serve as a potential information treasure house to the scientific community.

Impact of inorganic, organic and biofertilizers on performance of Mungbean (*Vigna radiata* L.) in *Tarai* region of Uttarakhand

Anil Kapoor*, Rohitashav Singh and Vijay Kumar Singh

Department of Agronomy, G.B. Pant Uni. of Agriculture & Technology, Pantnagar-263145

Author for correspondence- anilkapoorm5@gmail.com

Abstract

Mungbean (*Vigna radiata* L.) also known as green gram is the third most important pulse in country after chickpea and pigeon pea. It extensively cultivated and distributed all over the India. Due to its high nutritional content, it occupied an important place in nutritional diet. Mungbean seeds contain 24.7% protein along with good amount of vitamins and minerals. In India, Mungbean is cultivated over 20.3 lakh ha area and produced around 2.01 million tones with an average productivity of 467 kg ha^{-1}, contributing around 9.41% to total pulse production. There are several factors behind the low average productivity of mungbean in India and poor nutrient management is one of the important factors responsible for low productivity of mungbean crop. Which can be manage with appropriate management of nutrient supply. It not only maximizes production of pulse crop but also reduce the chance of adverse impact of poor nutrient management. Being a leguminous crop, mungbean can fix the atmospheric nitrogen but only after the nodule formation. Before that it requires supply of nutrient to establish itself. The application of fertilizers helps to achieve quick growth and healthy establishment but continuous use of only fertilizers has several adverse impacts. The application of organic manure improves the

soils physical, biological and chemical properties. The biofertilizers improves the root growth of plant and allows them to absorb more amounts of water and nutrient from soil. Keeping the above facts in view, the present experiment was conducted during 2019-20 of *kharif* season at N.E. Bourlog Crop Research Center, G.B. Pant University of Agriculture and Technology, Pantnagar. The experiment was laid out in factorial randomized block design with three factors 1. Inorganic fertilizers: 125% RDF, 100% RDF, and 75% RDF, 2.Organic manure: control and FYM 5t/ha and 3. Biofertilizers: *Rhizobium*, *LNM-16* and *Rhizobium* + *LNM-16* with three replications. The investigation findings shown that the treatment containing 125% RDF was recorded highest grain yield (919 kg/ha, straw yield 28.68 q/ha and biological yield 37.88 q/ha over other levels of inorganic fertilizers. In case of organic manure, the application of FYM @ 5t/ha recorded highest grain yield 942 kg/ha over control. The combined inoculation of biofertilizers *Rhizobium* + *LNM-16* found better as compared to *Rhizobium* and *LNM-16* in terms of grain yield, straw yield and biological yield. Thus, it concluded that the higher dose of recommended dose of fertilizers (125% RDF), application of FYM @ 5t/ha and combined inoculation of biofertilizers are found better over other treatments.

Key words- Mungbean, Inorganic, FYM, Biofertilizers, Organic

Genetic Variability Parameters for Cane Yield and Its Component Traits in Early Maturing Sugarcane *Saccharum officinarum*

PRAVEEN KUMAR, BALWANT KUMAR[1] and MAHESH KUMAR[2]

Department of Plant Breeding and Genetics, Bihar Agricultural University Sabour, Bhagalpur- 813210, [1]Department of Plant Breeding and Genetics, [2]Department of SMCA, Dr. Rajendra Prasad Central Agricultural University, Pusa-848125, Bihar, India

Corresponding author: Email- *praveen106kumar@gmail.com*

Abstract

Basic information on the genetic variations of varying metric traits in sugarcane is crucial for the proper planning of breeding strategies. With *15* early maturing sugarcane clone an experiment was conducted at Regional Research Station Madhopur during spring 2017 to study genetic variability parameters for cane yield and its components traits. Significant

differences among the clones for traits except purity percent was found as per analyses of variances. Characters *namely* single cane diameter at harvest and sugar yield at harvest revealed moderate GCV% and PCV%. High heritability coupled with high genetic advance as - per cent of mean (GA) was observed in cane diameter at harvest; while high heritability with moderate GA was found in number of shoots at 120 days, plant height at 150 days and at harvest, single cane weight, millable cane at harvest, sugar yield and cane yield at harvest specifying the role of additive gene effects in expression of these traits and its improvement through selection would be rewarding in early maturing clones of sugarcane.

Key words- Sugarcane, PCV, GCV, Heritability, Genetic advance

Assessment of inbreeding depression tolerance of local maize germplasm

Hiramani Barman*

Department of Plant Breeding and Genetics, Assam Agricultural University, Jorhat, India

***Email:** hiramonibarman93@gmail.com

Abstract

We carried out an experiment to study the inbreeding depression tolerance of maize germplasm. The field experiment was conducted at Assam Agricultural University during *rabi* season of 2019-2020. Six germplasm and their corresponding S_1 lines and one check hybrid were evaluated at randomized block design with two replications. Analysis of variance revealed that all the entries differed significantly for all the traits except moisture content. The entries namely, ARW1, ARY5, ARR1 and ASKAW1 which showed the minimum level of inbreeding depression from studies on inbreeding depression, can be used as components for developing high yielding and inbreeding tolerant composite variety in future.

Key words- Inbreeding, maize, germplasm, Northeast, S_1 lines

Eco-friendly management of seed discolouration of paddy

Praveen S. Patted, Atul Kumar, Sandeep Kumar Lal, Shyamal K. Chakrabarty, Bishnu Maya Bashyal, Ranjit Ranjan Kumar, Prolay Kumar Bhaumick, Shaily Javeria

Abstract

The current study was carried out for managing paddy seed discolouration using eco-friendly method with native biocontrol strains and their effects on growth and seed quality parameters as seed discolouration is now an emerging complex problem in rice. In dual culture assay, maximum per cent inhibition was recorded in *Trichoderma viride* (66.62(%)) followed *T. harzianum* (65.93(%)) whereas, minimum in *Talaromyces favus* (33.68 (%)) on the 7th day of incubation. Under field conditions, combination of seed treatment, seedling dip and the spray of *T. viride* performed better with all plant growth and seed quality parameters. In cultivars PS-5 and P-44 there were healthy seeds (67.32 and 64.39(%), respectively), discoloured seeds (22.10 and 23.03(%)), filled seeds (78.07 and 77.25(%)), unfilled seeds (22.10 and 23.03(%)) and yield (55.20 and 58.28 q/ha), respectively. Whereas, lower performance was observed in control (T10) of PS-5 and P-44 these were healthy seeds (%) (52.98 and 52.09), discoloured seeds (%) (16.51 and 17.98), filled seeds (%) (69.54 and 69.90), unfilled seeds (%) (30.46 and 29.89) and yield (43.43 and 50.72 q/ha) respectively. Similarly, T-7 performed better with respect to seed quality parameters of PS-5 and P-44 these were germination (%) (96 and 94(%)), dry weight (0.0970 and 0.0690 g), seedling length (26.03 and 27.03 cm), SVI-I was maximum in T-7 (2554.19 and 1885.07) SVI-II (9.30 and 6.59) and test weight (24.54 and 16.57 g). Whereas the least performance was seen in T-10 for seed quality parameters germination (%) (68 and 66), seedling dry weight (0.0860 and 0.0600 g) seedling length (19.87 and 22.50 cm), SVI-I (1445.67 and 1473.64), SVI-II (5.86 and 4.07) and test weight (24.04 and 16.22 g) respectively. Our results clearly show that grain discolouration can be efficiently managed using the native *Trichoderma viride* strain.

Key words- Seed discolouration, Paddy, Biocontrol agents, Seed quality parameters, Plant growth parameters

Role of Plant Growth Promoting Rhizobacteria (PGPR) in alleviation of salt stress

Divya Vani Vaka1, K. Pavani2, Prashant Kalal3, Abhilash Behra4

Dr. Y. S. R. Horticultural University, Venkataramannagudem, West Godavari District, Andhra Pradesh

Email: divyavani270742@gmail.com

Abstract

Salinity stress has been recognized as one of the major problems limiting the agricultural productivity across the globe. So, development of methods and strategies to ameliorate the deleterious effects of salt tolerance on plants has received considerable attention. Plant breeding, plant genetic engineering and a large variety of agricultural practices have been developed to improve plant defence against salt stress. Based on the current climate change scenario, the application of environmentally friendly strategies towards improving resource use efficiency while reducing non sustainable agrochemical inputs, represents a major challenge for global food production and security. So, harnessing the potential of beneficial microorganisms present in the rhizosphere such as plant growth promoting rhizobacteria (PGPR) to reduce the salt stress is imperative. Salt stress negatively impacts plans by production of reactive oxygen species which act as a signal during salt stress simultaneously injuring plant root and shoot tissue by disturbing enzyme, cell wall and membrane function. The bacterization of plants with PGPR aid to alleviate salinity stress in plants by boosting water absorption capability, enhancing essential nutrients uptake, accumulating osmolytes, increasing the activity of enzymatic and non-enzymatic antioxidants that scavange the ROS in plant tissues. Some of the PGPR commonly used in mitigating salinity conditions are *Azospirillum, Azotobacter, Arthrobacter, Enterobacter, Burkholderia, Bacillus* and *Pseudomonas*. The use of PGPR in agricultural field is a green option to increase productivity and crop yield.

Key words- PGPR, Salt stress, salinity

CONSERVATION AGRICULTURE- A RESILIENT TECH TO CLIMATE CHANGE

Manoharmayum Monica Devi

Department of Soil Science and Agricultural Chemistry, College of Agriculture, Central Agricultural University, Imphal, Manipur

E-mail Id: manoharmonica17@gmail.com

Abstract

In India, more than 600 Mt crop residues produced every year out of which 16% crop residue are burnt leading to release of greenhouse gases which is ultimate causes of changing climate (Chivenge *et al*., 2007). So, conservation agriculture (CA) is powerful mechanism to adopt to change by increasing resilience to drought and increasing water and nutrient use efficiency. It is an approach to farming that seeks to increase food security, alleviate poverty, conserve biodiversity and safeguard ecosystem services. Conservation agriculture is based on the three interlinked principles adapted to reflect local conditions and needs-minimum mechanical soil disturbance (i.e no tillage/zero tillage), permanent organic soil cover and species diversification. It is an agronomic practice that comprises minimum or zero tillage along with stable cover to soil with organic materials or by retaining residue of crops or growing green manure crops as cover crop and rotation of crops with pulses and legumes. The model delineation of the determinants of adoption of CA (Corbeel *et al*., 2014) are opportunities and trade off (T), fuel farming scale system context (C) and technical performance (P). In the situation where climate change is central in development policies and practices, conservation agriculture contributes to challenge of adapting agricultural practices resilient to climate change (Govaerts *et al*. 2009), FAO, 2011a). Eventhough adoption of CA in Indian context is still in the preliminary stage, widespread resource degradation, extreme climatic variability resulting a continuous threat to rural livelihood and reduce in economic and socio welfare situation felt the need to search for a suitable alternative measure of which CA prove as a vital tool in addressing this issue directly.

Keywords: Conservation, agriculture, climate, resilient and change

Seed priming effects on growth and yield of few varieties of rice (*Oryza sativa* L.) under moisture stress condition

Thoudam Anupama Devi

Department of Agronomy, College of Agriculture, CAU, Imphal-795004, Manipur

Author email: anupamathoudam1234@gmail.com

Abstract

The present investigation was carried out at rice research farm of College of Agriculture, Central Agricultural University, Imphal in kharif season of 2019 at polyhouse as a pot experiment to study the effect of seed priming treatments on growth and yield attributes of few rice varieties. Treatment consists of three variety of rice viz., CAU-R1, Keibu-Chiro and Kiophou and two priming chemicals viz., 2% KNO3, and 50 ppm Salicylic acid with one control (no priming). Water stress were created in each pot by maintaining soil moisture level at 32% by using soil moisture meter. The results showed that the maximum number of leaves per plant, leaf area, leaf area index, number of effective tillers per hill, panicle length, number of spikelet's per panicle, number of filled grains per panicle, grain yield, straw yield and harvest index were observed in variety CAU-R1 with treatment of 2% KNO3. The maximum plant height and leaf length were observed in variety Kiophou with treatment of 2% KNO3 and the maximum test weight was recorded in variety Keibu-chiro chemical priming with 2% KNO3. The highest gross return, net return and benefit: cost ratio (1.53) was obtained in variety CAU-R1 under 2% KNO3 treatment.

Key words- Seed priming, KNO3, rice and water stress.

Effect of different crop establishment methods and foliar spray of micronutrients on yield, economics and energetics of grasspea (*Lathyrus sativus L.*) in rice-fallow under red and lateritic soil of West Bengal

T. Das[1]*, A. K. Barik[2], P. De[1]

[1]Directorate of Agriculture (Govt. of W. B.)

[2]Professor of Agronomy, Palli Siksha Bhavana (Institute of Agriculture), Visva- Bharati, Sriniketan- 731236, Birbhum

Abstract

A two years field experiment was carried out at farmers' field at Birbhum district, West Bengal during *rabi* seasons of 2018-19 and 2019-20 to find out the effect of different crop establishment methods and foliar spray of micronutrients on yield, economic and energetics of grasspea variety Ratan (BioL 212) in rice- fallow. The experiment was laid out in split plot design with three replications consisting of three crop establishment methods (no tillage *utera*, zero tillage, conventional tillage) and four foliar spray of micronutrients (no micronutrient spray (water spray), foliar spray of Zn @ 0.05% twice at 30 and 45 DAS, foliar spray of B @ 0.1% twice at 30 and 45 DAS, foliar spray of Zn @ 0.5% + foliar spray of B @ 0.1% twice at 30 and 45 DAS). Among different crop establishment methods, highest seed yield was achieved under zero tillage (1033 Kg ha^{-1}) whereas foliar spray of Zn @ 0.5% + foliar spray of B @ 0.1% twice at 30 and 45 DAS registered highest seed yield (994 Kg ha^{-1}) among foliar spray of micronutrients. Different crop establishment methods and foliar spray of micronutrients had significant influence on gross return as well as net return of grasspea cultivation. Significantly higher gross return (₹ 59458 ha^{-1}) and net return (₹ 41937 ha^{-1}) of grasspea were obtained from the zero tillage when compared with other crop establishment methods. Among various foliar spray of micronutrients, foliar spray of Zn @ 0.5% + foliar spray of B @ 0.1% twice at 30 and 45 DAS showed significantly higher gross and net return (₹ 57212 ha^{-1}, ₹ 39756 ha^{-1} respectively). Energetics of grasspea cultivation was also significantly influenced due to different crop establishment methods and foliar spray of micronutrients. It was also observed that there was no significant interaction between different crop establishment methods and foliar spray of micronutrients in rice- fallow under red and lateritic soil of West Bengal.

Key words- Grasspea, rice-fallow, zero tillage, micronutrients, energetics

Plant breeding in post COVID 19 era: Plant Breeders should aim on Second Green Revolution

Shashidhara, N[1*], Dhanalakshmi, T. N[2] and Santosh, D. T[3]

[1]Assistant Professor, University of Agricultural Sciences, Dharwad

[2]Assistant Professor, Dept. of CIB, College of Horticulture, Hiriyur, UAHS, Shivamogga

[3] Centre for Smart Agriculture, Centurion University of Technology and Management, Odisha

***Correspondence Author:** N. Shashidhara, Assistant Professor, University of Agricultural Sciences, Dharwad.

Email: shashidhara.gpb@gmail.com; Mobile (whatsup): 8088401822

Abstract

Mankind has witnessed many pandemics over the course of human history that killed millions of people and ravaged the global economy and politics. In the current context, the world is facing yet another pandemic as Corona virus disease of 2019 (COVID- 19). Realizing the importance of situation, every country has undertaken special steps to fight against the pandemic mostly with non-pharmaceutical measures like social distancing and self-isolation with hygiene maintenance. In addition, restriction in travel and trade are done in majority of countries to limit the spread of the virus. All these combat against the pandemic has greatly affected the major economic sectors such as Agriculture and others. Agriculture serves as the most important economic sector endorsing food security and human development in most of countries including India. It is important to assess the effect of COVID-19 pandemic on Agricultural sector and Food as it primarily involves the sustainability of human life and secondarily involves the economy. To achieve sustainable food production to meet the demand of consumers, government needs to address quickly on agriculture sector to increase the production of agricultural commodities. Government needs to focus on the farmer's production as well as high yielding varieties development for various important major crops. Scientist / plant Breeders involved in varietal improvement should focus on the development of potential high yielding varieties to meet the demand of the nation for agricultural commodities. Plant breeders should use both conventional and molecular approaches breeding strategies for the development of high

yielding varieties (HYV). Various molecular breeding procedures will short cut the breeding procedures and help in the development of HYV / hybrids. Hence, there is an urgent need of second green revolution is a need an hour along with other agricultural related revolutions to fight against COVID 19 crises.

Key words- COVID-19, Pandemic, Plant Breeder, Green Revolution, HYV / hybrids.

UNDERSTANDING THE PLANT VOCABULARY AND ITS POSSIBLE IMPLICATIONS IN CROP BREEDING

S.T.R.K. Durga[1], Vinay Kumar[2], Krishnam Raju[3]

[1]M.Sc. Research Scholar, of M.S. Swaminathan School of Agriculture in Centurion University of Technology and Management

[2]Department of Genetics and Plant Breeding of M.S. Swaminathan School of Agriculture in Centurion University of Technology and Management

[3]Department of Genetics and Plant Breeding of M.S. Swaminathan School of Agriculture in Centurion University of Technology and Management

Email: stejareddy1705@gmail.com

Abstract

Plant vocabulary means the way that plant includes its complete morphology like shape of the leaf, the size of the seed, shape of the fruit, colour of the grain also we can say like complete architecture of the plant and its organization, also how the plant is performing its yield. If all the characters are good and plant is performing well better, then we can say like it is having good potentiality, good genetic diversity also, domestication of the plant because it is brought from the wild species to human management. Also, developing disease, insect resistance plants so that they give better yield and perform better. Like, they produce good grain shape, good size fruit, also size of the pods in case of pulses it will be good like in case of green gram shattering habit is they're that means when the pods occurrence begins, they get shattered so to check and to improve all these problems so many breeding programmes have been established. Also, now-a-days many molecular techniques are been established like genomics, proteomics, metagenomics and

transcriptomics etc. by using these methods we can sort many problems also we can improve disease resistance, insect resistance varieties.

Theme 6: Crop Production

Relationship between physiological growth parameters and yield of hybrid maize to graded levels of concentrated manures and macronutrient foliar spray under Surahonne (*Calophyllum inophyllum* L.) based agro-forestry system in Southern Transitional Zone of Karnataka

AKASH DANI, BHAIRAPPANAVAR S.T AND PRAKASH KOLER

1. M.Sc. Student of Agronomy, UAS, GKVK-Bangalore-06 2. Professor of Agronomy, College of Agriculture Karekere, Hassan 3. Assistant Professor of Crop Physiology, College of Agriculture Karekere, Hassan

Abstract

A field experiment was conducted during *Kharif* – 2017 at Biofuel Park, Madenur, University of Agricultural Sciences, Bengaluru, on sandy loam soil with neutral in reaction (pH 6.8) and the electrical conductivity was normal (0.26 dSm^{-1} at 25 °C). The available nitrogen present in the soil was Medium (310.50 kg ha^{-1}) and the available phosphorus was high 34.6 kg $ha^{-1}$and potassium 243.9 kg ha^{-1}. The experiment comprised of seven treatments with three replications laid out in RCBD. The investigation revealed that significantly higher kernel yield and stover yield (72.50 and 97.70 q ha^{-1}, respectively) was recorded with application of recommended package (100:50:25) N, P_2O_5, K_2O ha^{-1} + FYM @ 5 t ha^{-1}. High yielding ability of the crop with this treatment was attributed to better physiological growth factors viz., significantly higher absolute growth rate at 0-30, 30-60 and 60-90 DAS, growth stages (0.75, 5.21 and 7.96 g day^{-1}, respectively), relative growth rate at 0-30 and 60-90 DAS, growth stages (0.102 and 0.031 g $plant^{-1}$ day^{-1}, respectively) and significantly higher crop growth rate at all the growth stages (0.0033, 0.0032, and 0.0044 g cm^{-2} day^{-1} at 0-30, 30-60 and 60-90 DAS, respectively) .

Role of microbes in climate resilience and sustainable crop production

Gopavaram Pavithra

College of Horticulture, Anantharajupeta, Rly. kodur. pincode.510105

Email: gopavarampavithra@gmail.com

Abstract

The soil microbiome governs biogeochemical cycling of macronutrients, micronutrients and other elements vital for the growth of plants. In the current scenario of rapidly evolving climate change, crop plants are more frequently subjected to stresses of both abiotic and biotic origin, including exposure to unpredictable and extreme climatic events, changes in plant physiology, growing season and phytosanitary hazard, and increased losses up to 30% and 50% in global agricultural productions. Such circumstances demand the use of improved agricultural practices, environment friendly and climate resilient technologies, microorganisms, being ubiquitous and abundant in the soil environment, are the key players regulating the earth's biogeochemical systems. These microbes may be helpful in sustainable crop production by providing protection to plants from harmful pests and pathogens, by enhancing plant growth, by alleviating environmental and nutrient stress that facilitating plants to several functional traits.

Key words- Soil microbes, Biotic stress, Abiotic stress, Sustainable crop production

Boron status of soils of Assam

Biplab Choudhari[1], Anjali Basumatary[2], Ipsita Pattanaik[3], Gourav Jatav[4]

[1-2]Assam Agricultural University, Assam, Jorhat-785013

[3-4]Indira Gandhi Agriculural University, Raipur (C.G)-492012

Corresponding Author-Biplab Choudhari

Dept. of Soil Science, AAU, JORHAT

Email: biplavchoudhary92@gmail.com

Abstract

A study was undertaken to assess the available boron status and its critical limits for cauliflower in soils of Assam. Two hundred surface soil samples representing four agro-climatic zones of Assam were collected covering fifty locations in each zone and analysed for hot water soluble boron (HWS-B) and some important soil physico-chemical properties. A wide variation was observed in HWS-B and physico-chemical properties among the four agro-climatic zones of Assam. Soils from Upper Brahmaputra Valley Zone recorded higher mean value of HWS-B, clay, organic carbon, CEC, available nitrogen and phosphorus than that of other three agro-climatic zones. HWS-B exhibited a significant positive correlation with organic carbon, CEC, available nitrogen and available sulphur indicating their dominant influence on boron status of these soils. Among the zones, soils from Lower Brahmaputra Valley Zone showed the highest deficiency in HWS-B with 36 per cent and the lowest deficiency was found in Upper Brahmaputra Valley Zone with 28 per cent.

Key words- Boron status, Hot Water Soluble Boron

Modern Approach to Reduce Ill Effects of Climate Change from Resilient Agriculture

Smita Kumari[1], Harmit Singh Thind[2]*, Rajneesh Kumar[3] & Pravin L Chaudhry[4]

[1,2]Department of Agronomy, School of Agriculture.

[3, 4]Department of Genetics and Plant Breeding, School of Agriculture.

Lovely Professional University, Phagwara-144411, Punjab, India.

***Corresponding author:** harmit.22861@lpu.co.in*

Abstract

Agriculture and climate mitigation have some correlation with each other in different aspects, as climate mitigation is the major cause of stresses i.e. Abiotic and Biotic, which have adverse effects on the crops of any region. Climate mitigation via different ways like variations in annual rainfall, average temperature, modifications in weeds, reproductive rate of pests or pathogens, global atmospheric CO_2 or O_3 level etc. The threat of changing global climate has greatly driven the attention of scientists, as these changes threaten crop production and food security worldwide. Climate-resilient agriculture is the only way to reduce negative impact of climate mitigation on crop adaptation. In this paper, we summarize the stresses produced due to climate mitigation, some modern breeding technologies and biotechnological strategies to develop climate resilient crops. Some agencies which play a crucial role to strengthen the seed village concept are State Departments of Agriculture, KVKs, State & National Seeds Corp., State Farms Corporation of India (SFCI), and State Seeds Certification Agencies etc. in a coordinated effort. There are some implementations which are of seed village and seed banks concept in different parts of the country which can further upscale to bear with climate variability such as, community seed banks for flood tolerant rice varieties of Bihar and Bengal, saline-resistant rice varieties of Orissa (Wajih 2008). An approach for stress tolerant cultivars has a prime importance in the present context of climate mitigation apart from various adaptation strategies to sustain the increasing population of the globe. National Agricultural Research System (NARS) efforts from few decades resulted in development of multiple stress tolerance. Stress tolerant cultivars can play a crucial role to survive the climate

variability as well as enhancing the productivity. Marker-Assisted Breeding and the genetic resources i.e. land races and wild relatives mimicked the future genotypes for breeding of tolerance crops.

Key words- Mitigation, KVKs, Resilient, Tolerance, Saline, land races, Breeding.

Evaluation of Onion varieties for Kharif season under Telangana conditions

A. Mamatha, M. Hanuman Nayak, D. Anitha Kumari, V. Suresh and A.V.N. Lavanya

Vegetable Research Station, Sri Konda Laxman Telangana State Horticultural University, Rajendranagar, Telangana, Hyderabad – 500030, India

Email: mamathahorti@gmail.com

Abstract

Onion (*Allium Cepa* L.) is one of the important commercial vegetable crops grown in India for both domestic consumption and export. The production and productivity of onion mainly depends on selection of season suitable varieties. Hence, the present investigation was carried out under All India Network Research Project on Onion and Garlic operating at Vegetable Research Station, Sri Konda Laxman Telangana State Horticultural University, Hyderabad during Kharif 2018-19 with 17 varieties (Bhima Dark Red, Bhima Shubra, DOGR Hybrid-8, Bhima Shwetha, BSS – 133, Bhima Super, BSS-441 (Pune Red Hybrid) , L-883, L-849, L-857, DOGR-344, DOGR-WHY-1, DOGR-361, DOGR KH M-3, DOGR-WHY-2, DOGR KH-M-4 and BSS- 262) supplied by DOGR-ICAR Rajgurunagar, Maharashtra. Six week old seedlings of each variety were transplanted in raised beds at a spacing of 15 cm x 10 cm in a plot size of 3 m x 2 m. The trial was laid in randomized block design with three replications. The results on analysis exhibited a significance difference among the varieties. Highest marketable yield/ha was observed in BSS-441 (Pune Red Hybrid) (573.75 q/ha) followed by BSS-133 (484.11 q/ha) and L -883 (484.01 q/ha) which are on par with each other and minimum was recorded in Bhima Super (189.69 q/ha). Increased bulb weight and size may be due to

humus substances which mobilized the reserve food materials to the sink through increased activity of hydrolyzing and oxidizing enzymes. The results of the different varieties tested for cultivation in kharif season revealed that the variety BSS-441 (Pune Red Hybrid) (573.75 q/ha) can be used and may be recommended for commercial cultivation during Kharif season in Telangana condition.

Impact of Climate Change on Agriculture

Ipsita Pattanaik[1], Biplab Choudhari[2]

Indira Gandhi Agricultural University, Raipur (C.G)-492012

Corresponding Author-Ipsita Pattanaik

Dept. of Soil Science, IGKV, Raipur

Email: ipsu1993@gmail.com

Abstract

Global climate change is a change in the long-term weather patterns that characterize the regions of the world. The term "weather" refers to the short-term (daily) changes in temperature, wind, and/or precipitation of a region (Merritts et al. 1998). In the long run, the climatic change could affect agriculture in several ways such as quantity and quality of crops in terms of productivity, growth rates, photosynthesis and transpiration rates, moisture availability etc. Climate change is likely to directly impact food production across the globe. Increase in the mean seasonal temperature can reduce the duration of many crops and hence reduce the yield. In areas where temperatures are already close to the physiological maxima for crops, warming will impact yields more immediately (IPCC, 2007). Drivers of climate change through alterations in atmospheric composition can also influence food production directly by its impacts on plant physiology. The consequences of agriculture's contribution to climate change, and of climate change's negative impact on agriculture, are severe which is projected to have a great impact on food production and may threaten the food security and hence, require special agricultural measures to combat with.

Key words- Climate change, Greenhouse Effect, Greenhouse gases (GHGs), Global Warming Potential (GWP), Inter governmental Panel on Climate Change (IPCC), parts per million (ppm).

Sustainable Agriculture: Economic & Traditional Farming

Naseeb Choudhary[1*], Sumit Kumar[2], Vinod Kumar[3], Mahender Kumar Rojh[4], Jaipal[5], Jasveer Singh[6], Anuj Muhal[6], Ankur[7]

[1]Department of Agricultural Economics, CCS Haryana Agricultural University, Hisar

[2]Department of Agronomy, Punjab Agricultural University, Ludhiana

[3]Department of Agronomy, Vivekananda Global University, Jaipur

[4]Department of Agronomy, SK Rajasthan Agricultural University, Bikaner

[5]Department of Extension Education, NDUAT, Ayodhya

[6]Department of Plant Pathology, SK Rajasthan Agricultural University, Bikaner

7Department of Entomology, MPUAT, Udaipur

Corresponding Author Email: shivsambhu41@gmail.com

Abstract

The world needs of Sustainable development for agriculture, because day after day productivity of land decreasing by highly use of fertilizers and pesticides. Then the perfect combination of modern and traditional farming is great for new revolution against climate change. Sustainable agriculture is necessary to attain the goal of sustainable development. According to the FAO, sustainable agriculture is the successful management of resources to satisfy the changing human needs while maintaining or enhancing the quality of environment and conserving natural resources. All definitions of sustainable agriculture lay great emphasis on maintaining an agricultural growth rate, which can meet the demand for food of all living beings without draining the basic resources towards crop improvement. Organic farming is one of the several approaches found to meet the objectives of sustainable agriculture. Most of the techniques used in Sustainable farming like inter-cropping, crop rotation, mulching and integration of crops and livestock are not alien to agriculture systems including the traditional agricultural practices. In modern world, continues growth of population create a concern for Agriculture Scientists as well as

farmers about completing food demand of people, for highly production- Economic farming is on trend. The adverse effects of modern agricultural practices on the farm and also on the health of living beings and thus on the environment has been well documented all over the world. Application of technology, particularly the use of chemical fertilizers and pesticides all around us has persuaded people to think aloud. As a result of global climatic changes, their negative effects on the environment are manifested through soil erosion, temperature increase, water shortages, salination, soil contamination. Sustainable farming is one of the widely used methods, which is thought as the best alternative to avoid the ill effects of modern farming. It also has far more advantages over the conventional and other modern agricultural practices.

Key words- Climate Change, Economic, Organic, Sustainable Farming

GENETIC, BIOCHEMICAL AND MOLECULAR BASIS OF MALE STERILTY IN VEGETABLE CROPS

Indraja G[1], Dharmateja P[2], Sadarunissa Syed[3]

[1] Division of Vegetable Science, Ph.D. Scholar, Dr.Y.S.R Horticutural University, A.P.

[2] Division of Genetics and Plant Breeding, Ph.D. Scholar, Indian Agricultural Research Institute, New Delhi

[3] Division of Vegetable Science Associate Professor, Dr.Y.S.R Horticutural University, A.P.

E-mail: indraja226@gmail.com

Abstract

Male sterility is defined as the failure of plant to produce functional anthers, pollen or male gametes. J. K. Koelreuter observed anther abortion within species & species hybrids and was first to report male sterility in plants. The phenomenon of male sterility is of special interest for the plant breeders to produce more efficient and economic hybrid seed in number of vegetable crops. Discovery of certain male sterile mutants which eliminate more laborious operations of emasculation combined with various marker genes further facilitates identification of undesirable types even at seedling stage, which has widened the

very basis of hybrid seed production. Kaul (1988) classified male sterility in two major groups viz., genetic (spontaneous or induced) and non-genetic (induced) male sterility. Expression of male sterility trait is associated with a large number of morphological, genetic, histological, biochemical and molecular changes in male reproductive tissues at various stages of microsporogenesis and microgametogenesis. The male sterile plants were either isolated in natural populations or were artificially induced through mutagenesis. In recent past, male sterility systems were also developed through engineering and protoplast fusion. Some examples of male sterility in vegetable crops i.e., in muskmelon five male sterile genes were identified (*ms-1, ms-2, ms-3, ms4,* and *ms-5).* In onion First CMS was reported in the progenies of cultivar Italian Red. Three CGMS based hybrids i.e., Arka Meghna (MSH-172), Arka Harita (MSH-149) and Arka Sweta (MSH-96) have been developed at IIHR, Bangalore.

Key Words- Male sterility, Vegetables, GMS and CGMS

AGRO - ECOLOGICAL OPTIONS FOR FALL ARMYWORM MANAGEMENT IN MAIZE

V SUJATHA

Agricultural Research Station, Peddapuram, East Godavari Dist.

Acharya N.G. Ranga Agricultural University (ANGRAU), Guntur, Andhra Pradesh – 531001

[1*]***Presenting Author, Email:*** sujatha.agro12@gmail.com

Abstract

Maize (*Zea mays*) is the 3rd most preferred cereal crop in India after wheat and rice. Recently invasion of Fall army worm (FAW), Spodoptera frugiperda (J.E. Smith), in maize created havoc among farmers in various maize growing states. Agro-ecological approaches offer culturally appropriate low-cost pest control strategies that can be readily integrated into existing efforts to improve smallholder incomes and resilience through sustainable intensification. Among them, planting leguminous inter-crops or cover crops improves soil fertility through nitrogen fixation, diversifies the field environment for beneficial insects, including insect predators and parasitoids with considerable system yield advantage and

income. Hence, a field trial was conducted at Agricultural Research Station, Peddapuram, East Godavari Dist. during *kharif*, 2020-21 to investigate the influence of intercropping maize with edible legumes in reducing the abundance of FAW. This experiment was carried out in Factorial RBD design with three replications comprising ten treatments *viz.*, two row arrangements (regular 1:1 and paired 2:2) and four legume intercrops (Green gram, Black gram, Cowpea and Groundnut,) and control (sole maize). The sole maize and intercrops were raised as per the recommended package. The data on percent plant infestation of FAW at 10 days interval starting from date of first infestation to till harvest on maize and intercrops and severity of infestation based on Davis scale starting from date of first infestation till harvest has been recorded along with the yield advantage with maize based intercropping system.

The results of the study indicated that significantly highest maize grain yield was observed with regular row arrangement than paired row planting. Grain yield of maize was not significantly affected by Intercropping of maize with edible legumes. In-terms of FAW infestation and severity there was no difference was observed among the row arrangement. When leguminous crops intercropped with maize, levels of FAW infestation and severity were relatively similar and differences were not significant.

Key words- Maize, pulses, row arrangement, Intercropping, FAW, yield

Phenology and productivity of chickpea genotypes as influence by sowing time in the Northern Dry Zone of Karnataka

M.P. Niveditha*, S.B. Patil and S.B. Kalaghatagi

Department of Agronomy, College of Agriculture, Vijayapura, 586101
University of Agricultural Sciences, Dharwad, Karnataka, India

***Corresponding author:** neethump97@gmail.com

Abstract

The sowing time affects the crop growth and yield of chickpea. There is a need to adjust the sowing time with suitable genotypes for obtaining higher yields. Optimum sowing time is considered for maximum advantages of environmental conditions, especially in terms of

the thermal requirement and solar radiation received by the crop canopy. In this context, an experiment was conducted at the Regional Agricultural Research Station, Vijayapura, Karnataka to study the growth and yield of chickpea genotypes under different sowing times. The experiment was laid out in a split-plot design with four sowing dates (1st fortnight of October, 2nd fortnight of October, 1st fortnight of November and 2nd fortnight of November) as main plot treatments and three genotypes (JG-11, BGD-111-1 and JG-14) of chickpea as subplot treatments and replicated thrice. The results indicated that sowing of chickpea during 1st fortnight of October recorded a significantly higher seed and haulm yield (1913 and 2304 kg ha^{-1}, respectively) and number of pods per plant (40.31) and was found on par with 2nd fortnight of October sowing. Among the genotypes, JG-11 recorded a significantly higher seed yield (1848 kg ha^{-1}) followed by BGD-111-1 (1748 kg ha^{-1}) and JG-14 (1521 kg ha^{-1}). The interaction effect showed that the genotype JG-11 sown during the 1st fortnight of October recorded higher seed yield (2168 kg ha^{-1}) and net returns (₹ 69,699 ha^{-1}) over other interactions, but it was on par with BGD-111-1 sown at the same period and JG-11 sown during the 2nd fortnight of October.

Key words- Genotypes, chickpea, seed yield, net returns.

Evaluation of suitable alternative crops and cropping systems for Sugarcane in Northern Transition Zone of Karnataka

SADASHIVANAGOWDA, S.N.O*., ALAGUNDAGI, S.C. and NADAGOUDA, B.T.

Department of Agronomy, College of Agriculture, UAS, Dharwad-05, Karnataka, India

***Corresponding author e-mail ID*:** ssgkrishiach21@gmail.com

Abstract

The sugarcane crop is extensively grown in many parts of India, but its monocropping has led to many problems *viz.*, soil salinity, disruption of physico-chemico-biological properties of soil, unscientific water management, dominance of pest and diseases incidence and increased cost of cultivation annually. Late release of canal water coupled with non-availability of water to the tail end farmers and also sugar factories unable to

clear the cane arrears to farmers every year are the other constraints. In this context, to evaluate the suitable alternative crops and cropping systems for sugarcane, the field experiment was conducted at Agricultural Research Station, Hukkeri, Belagavi district in Northern Transition Zone of Karnataka during 2018-20. There were 11 treatments consisting of soybean - sorghum - ridge gourd (T_1), pigeon pea + green gram (1:1) - beans (T_2), pigeon pea + soybean (1:1) - cowpea (T_3), soybean - wheat - groundnut (T_4), groundnut - sorghum - sesame (T_5), maize - cabbage - fallow (T_6), soybean - wheat - green gram (T_7), maize - wheat - sesame (T_8), Bt cotton - groundnut (T_9), sugarcane + onion (1:2) (T_{10}) and sugarcane (sole) (T_{11}), replicated thrice and laid out in Randomized Complete Block Design. The two years pooled results revealed that, maize-cabbage-fallow cropping system recorded significantly higher sugarcane equivalent yield (SEY) [179.08 t ha^{-1}], net returns (Rs. 2,49,923 ha^{-1}) and B:C ratio (2.54) compared to sole sugarcane (111.00 t ha^{-1}, Rs. 1,21,919 ha^{-1} and 1.97, respectively). The other significant alternative cropping systems involving only field crops were soybean-wheat-groundnut (120.24 t ha^{-1}, Rs. 1,51,651 ha^{-1} and 2.21), maize-wheat-sesame (117.96 t ha^{-1}, Rs.1,50,231 ha^{-1} and 2.28), soybean-wheat-green gram (107.55 t ha^{-1}, Rs.1,40,907 ha^{-1} and 2.29) and Bt cotton-groundnut (101.71 t ha^{-1}, Rs.1,33,519 ha^{-1} and 2.40), respectively. As these alternative cropping systems are more productive, can be recommended as viable option to sugarcane monocropping in Northern Transition Zone of Karnataka.

Key words- Sugarcane, alternative cropping system, sugarcane equivalent yield, monetary advantage

IMPACT OF NEW GENERATION FUNGICIDES IN PLANT HEALTH MANAGEMENT

Surpati Anand*, Shatrudhan Kumar Choudhary, Kumar Suman, Sourabh Kumar

Department of Plant Pathology, Bihar Agricultural University, Sabour, Bhagalpur-813210

***Corresponding author*:** surpatianand1234@gmail.com

Abstract

In the modern, intensified agriculture, the efficient management of plant diseases is essential. At present the most reliable means of doing this is by the use of fungicides. Fungicides are the toxic substances which either kill or check the growth of the fungi. During the last two decades, fungicide research has produced a diverse range of fungicidal products with novel modes of action which had a significant impact on plant disease control. The need for new and innovative fungicides is driven, among other factors, by resistance management, regulatory hurdles, and increasing customer expectations. Compounds having a novel mode of action are of course of special interest, since they play a key role in resistance management strategies, but equally important are new fungicides with enhanced characteristics such as systemicity, curativity, and longevity of disease control. The technical feature of new generation fungicides are target specific action and safer to non-target sites. Over the past few years, however, several truly novel compounds have been launched commercially and have reached an advanced stage of development, which include phenylpyrroles, anilinopyrimidines, strobilurin analogues etc with effects on respiration, cell membrane components, protein synthesis, signal transduction and cell mitosis. Many of the important plant diseases, which were not controlled satisfactorily by the previous traditional fungicides, can now be well managed by the new compounds which are mostly systemic in nature. In view the risk of resistance development with most of the systemic, site specific compounds, there is a need to develop more classes of fungicide with novel target sites.

Key words- New generation, Fungicides, Strobilurins

ALLEVIATING THE MENANCE OF CROP RESIDUE BURNING

Aishani Chowdhury, Srija Majumdar, and Madhuwrita Shit

Centurion University of Technology and Management, Paralakhemundi, Odisha, India-761211

Abstract

Burning of crop residues in the North Western states of India has become an environmental and health hazard not only in the region, where it is practiced, but also in the surrounding states. It is responsible for thick smog in the months of November and December each year. This is due to a short (2-3 weeks) turn-over period between rice harvest and wheat sowing. Hiloidhari *et al.* (2014) estimated that about 686 million tonnes (Mt) of crop residues are made available by 26 crops in India, out of which cereals contribute 398 Mt (54%) followed by sugarcane, contributing 111 Mt (16%). Rice straw contributed 40% of the total residue burnt followed by wheat straw (22%) and sugarcane trash (20%). The inappropriate management of crop residues will further lead to continuous depletion of soil fertility and deterioration of atmospheric quality. Hence, there is a need to develop efficient crop residue management strategies to prevent the wastage of this valuable natural resource. The recycling of crop residues offers a sustainable and ecologically sound option for restoring soil health and agricultural intensification. It can play an important role in C sequestration at 0.2 x $l0^{15}$ g $year^{-1}$ to improve the soil organic carbon (SOC) pool. Retaining crop residues as mulch on the soil surface, in situ incorporation, zero till seeding and mulching, transportation to fodder deficit states, ethanol and biofuel production on industrial basis, producing compost and biochar are the most effective approaches to improve soil, air, and water quality. The aim of this presentation is to explore the feasibility of different crop residue management options for replenishing and sustaining soil health and environmental security. It mainly focuses on the possible alternatives for efficient recycling of surplus crop residues to improve soil and environmental security and sustainable crop production in cereal-centric intensive cropping systems of India. Hence it will help producers, researchers, academicians, and policymakers to achieve the "Sustainable Development Goals" in India.

Key words- Crop residues, C Sequestration, Soil – Environment Health, Biochar, Mulching, Sustainable development

Sustainable intensification of rainfed farming through millet – pulse based cropping system

Sunil Kumar, M and Suneel Kumar, G. V.

Agricultural Research Station, ANGRAU, Darsi, Prakasam District, Andhra Pradesh, India

Abstract

Rainfed areas are less explored for cropping sequence but are suitable to adopt rather than growing long-duration single crop. Rainfed regions of the Prakasam district, because of deep rooting habits and drought tolerance farmers adopted pigeon pea in the majority of the area. Long crop duration and low productivity force the small and marginal farmers economically more vulnerable ultimately pigeon pea farming is un-profitability. To evaluate the suitable millet pulse based cropping system suitable for rainfed alfisols of the Prakasam district field experiment was conducted during the 2016-17 cropping season with foxtail millet and Bajra based cropping systems were tested against the long duration red gram sole crop at ARS, ANGRAU, Darsi, Andhra Pradesh, India. The experimental site falls under semi-arid climatic conditions with a bimodal distribution of rainfall in the monsoon and post-monsoon seasons. The results revealed that in *kharif* season foxtail millet and bajra grew as intercrop in red gram recorded reduction in yield and yield attributes than sole crops due to inter-plant competition. During *rabi* season, in foxtail millet followed by pulse sequence cowpea crop recorded highest yield attribute except for pods per plant which were recorded in black gram. In similar trend was observed in bajra followed by pulse sequence. The highest system productivity, gross returns, and red gram equivalent yields were recorded in foxtail millet followed by black gram crop sequence but the cost-benefit ratio was highest in red gram followed by foxtail millet cropping sequence. Instead of long duration sole red gram, adopting a cropping sequence of foxtail millet followed by the black gram maximizes net returns.

Crop Residue Management in promoting Physical, Chemical and Biological properties of the Soil

M. Chandana, Ph D scholar (soil science), **B. Kranthi kumar**, Scientist (soil science), **E.Anusha** Ph D scholar,(Agronomy), **I. Venkatesh**, Ph D scholar, (soil science), **V. Prasad,** Ph D scholar , (soil science)

College of Agriculture, PJTSAU, Rajendra Nagar

Abstract

Due to the scarcity of alternative organic amendments, the retention of crop residue in fields can be considered key in promoting physical, chemical, and biological attributes of soil health in agricultural systems of developing countries. There are 140 million ha operational holdings in the country and about 80% are marginal and small farmers. Crop residues of common agricultural crops are important resources, not only as sources of nutrients for succeeding crops, but also for improved air, water and soil quality. Improved residue management and reduced tillage practices should be encouraged because of their beneficial role in reducing soil degradation and increasing soil productivity. They are used as surface mulch, and improves soil structural properties by increasing soil organic matter concentration. The effectiveness of crop residue cover is a function of percent of soil surface cover, soil textural class, topography, intensity of rainfall, and velocity of wind. The amount of crop residue required for maintaining the essential nutrients is more than required for reducing soil erosion to tolerable limits. Removal of crop residues reduces earthworm population and the number of surface-connected macro pores because residues are a food source and habitat to soil macro- and microorganisms. The decrease in earthworm population with increase in rate of residue removal is attributed to the decrease of food supply, lack of protective surface cover, and increase in fluctuations in soil temperature. Food security and environmental improvement depend on soil carbon, a valuable resource that can be sustainable in agro-ecosystems through improved and cost-effective crop residue management.

Key words- Crop residues, soil structure, soil organic matter, earthworms.

ASSESSING THE PERFORMANCE OF DUAL PURPOSE MAIZE

Gauri Mohan[1] and Dr Khogen Kurmi[2]

[1]Ph.D. scholar, Department of Agronomy, SASRD, Nagaland University

[2] Professor, Department of Agronomy, Assam Agricultural University

***E-mail id**:* gaurimohan123@gmail.com

Abstract

Field trial was conducted during *rabi* season of 2016-17 at the Assam Agricultural University to assess the performance of dual-purpose maize. The experiment was laid out in factorial RBD. The treatment consisted of eight crop management practices *viz*., Grain crop at 60 cm x 30cm (T_1), Fodder crop at 30 cm x15 cm (T_2), Fodder cum grain crop at 30 cm x 30 cm with removal of alternate rows at knee-high stage for fodder (T_3), Fodder cum grain crop at 30 cm x 30 cm with removal of alternate rows at tasseling stage for fodder (T_4), Fodder cum grain crop at 30 cm x 30 cm with removal of alternate rows at milking stage for fodder (T_5), Fodder cum grain crop at 30 cm x 15 cm with removal of alternate rows at knee-high stage for fodder (T_6), Fodder cum grain crop (30 cm x 15 cm) removal of alternate row at tasseling stage for fodder (T_7), Fodder cum grain crop at 30 cm x 15 cm with removal of alternate rows at milking stage for fodder (T_8) and two levels of fertilizer *viz*., F_1: 100% of RDF and F_2: 150% of RDF. The highest grain yield being 34.21 q ha^{-1} and was produced from T_1 which was *at par* with crop management practice T_6, T_7 and T_8. However, green fodder yield (164.04 q ha^{-1}) and dry matter yield (35.31 q ha^{-1}) was found to be highest in crop management practice T_2. Among the fertilizer levels F_2: 150% of RDF recorded the highest grain yield and green fodder.

Key Words- Dual, maize, fodder, tasseling, milking.

EFFECT OF FINGER MILLET+BLACKGRAM INTERCROPPING SYSTEM ON GROWTH, YIELD AND COMPETITIVE INDICES OF FINGER MILLET

Girisha, G.C. Bhairappanavar S.T. Prakash Koler

College of Agriculture Karekere, Hassan, UAS, GKVK-Bangalore-06

Email: *stb1966@gmail.com*

Abstract

A field investigation on "Effect of finger millet + blackgram intercropping system on growth, yield and competitive indices of finger millet" was conducted during *Kharif* season of 2012-13 at Agriculture College Hassan, University of Agricultural Sciences, Bangalore, Karnataka, showed that significantly higher grain and straw yield of finger millet was recorded in sole finger millet (3017 and 11410 kg ha^{-1}, respectively) and it was closely followed by finger millet + blackgram in 4:1 row proportion(2668 and 9511 kg ha^{-1}, respectively). The intercropping of finger millet + blackgram (4:1) under transplanting method of establishment recorded higher crop equivalent yield (3357kgha^{-1}) and higher LER (1.11). The intercropping of finger millet + blackgram (4:1) with transplanting method of establishment recorded higher gross returns (Rs 95,710ha^{-1}), net returns (Rs 48,796.50 ha^{-1}) and B:C ratio (1.39). Higher LER (1.11), RCC (4.12), ATER (1.04), Agressivity (0.26) FEY (3357.62 kg/ha) were recorded in transplanted finger millet + blackgram (4:1) inter cropping system under transplanted method of finger millet establishment than sole crop of finger millet and other ratio.

Vegetable Grafting: An Alternative Approach towards Biotic and Abiotic Stresses

Smaranika Mohanta, K. Srikant, G.S.V. Lakshmi and Deepankar Jana

Centurion University of Technology and Management, Odisha, India

Corresponding email: smaranika.mohanta@cutm.ac.in

Abstract

Vegetables are high-valued, nutritional and remunerative enough to replace subsistence farming. Grafting is known as a horticultural technique where plant parts like rootstock and scion joint together and produce a single plant. Grafting in vegetable crop is a new technique in India. Commercially vegetable grafting is practiced in tomato, brinjal, pepper, cucumber, watermelon and muskmelon. Commonly practiced techniques are tongue approach grafting, cleft grafting, hole insertion grafting, one cotyledon grafting, tube grafting, pin grafting and double grafting. It is an alternative source for tolerant biotic and abiotic stresses and influences earliness in flowering, improve plant vigour, quality and higher yield in different crop. It imparts resistance against various nematodes or soil borne diseases like bacterial or fungal disease or viruses, especially after the ban of effective soil fumigants like methyl bromide and the restriction of pesticides. Vegetable grafting is the most effective and sustainable solution for agricultural production. It is also an alternative to slow approach of breeding for increased environmental-stress tolerance of vegetables. Vegetable grafting is future challenging for sustainable agriculture in worldwide due changes of environment condition and new pests and diseases.

Key words- Grafting, Grafting methods, Biotic and Abiotic factors

Impact of Integrated Nitrogen Management on Productivity and Post-Harvest Nutrient Status of Maize

TABUILIU ABONMAI

Department of Agronomy, College of Agriculture, Central Agricultural University, Imphal

E-mail id: buibuiabonmai@gmail.com

Abstract

A field experiment was conducted during the pre-*kharif* season at experimental field of College of Agriculture, Central Agricultural University, Imphal, Manipur to study the integrated nutrient management effect on productivity and post-harvest nutrient status of maize in Manipur. The results revealed that the grain and stover yield of maize respond well to integrated nitrogen management rather than sole application of either chemical fertilizer (urea) or FYM. Residual available nitrogen, phosphorus, potassium and organic carbon were maximum with application of RDN- 100% through FYM. Lowest soil nutrient value was observed in treatment where the crop received only chemical fertilizer. From the economic point of view, the highest monetary benefit in terms of net return and benefit cost ratio was associated with application of RDN-75% through urea + 25% through FYM.

Key words- Maize, INM, yield, nutrient, post-harvest

Seed priming and foliar nutrition can enhance the growth and productivity of black gram [*Vignamungo* (l) *hepper*]

SahujiBandyopadhyay[1]* and Rambilash Mallick[2]

[1]Department of Agronomy and Agroforestry, M S Swaminathan School of Agriculture, Centurion University of Technology and Management, Odisha, India

[2]Dept. of Agronomy, Institute of Agricultural Science, University of Calcutta, West Bengal, India

Correspondence: sahuji.bandyopadhyay@cutm.ac.in

Abstract

Pulses are the major source of dietary protein, energy, minerals and vitamins for the mankind. Beside this they maintain soil fertility through biological nitrogen fixation in soil and addition of organic matter through leaf fall, flower drop, etc., thus play a vital role in furthering sustainable agriculture. Black gram (*Vigna mungo*) generally gives low seed yield mainly due to poor management and low soil fertility. Keeping this in view a field experiment was conducted at agricultural experimental station of University of Calcutta, Baruipur, West Bengal (88°26'E Longitude and 22°22' North Latitude) during the summer season to find out the effect of seed priming followed by foliar application with different nutrient solution towards growth and productivity of black gram. The experiment was laid out in a Factorial Randomized Block Design with three replications. Three levels of seed priming (no seed soaking, seed soaking in water and seed soaking in 1% N: P: K-10:26:26 solution for 8 hours) along with four levels of foliar spray including water (control), 2% N: P: K-10:26:26 solution, 2% N: P: K-20:20:20 solution and 2% DAP solution at pre flowing and 50% flowering stage, thus giving 12 treatment combinations altogether. The cultivar 'B-76' (*Kalindi*) was used with its general package of practices. The results revealed that seed priming with 1% N: P: K-10:26:26 solution enhanced the different growth parameters and produced significantly higher grain yield (12.16 q ha^{-1}) over non-primed seeds (10.41 q ha^{-1}), regardless of foliar nutrition. Similarly, among the different foliar spray the maximum growth and grain yield (12.39 q ha^{-1}) were obtained from 2% N: P: K-20:20:20 solution over the control (10.73 q ha^{-1}). Thus, it can be concluded that the seed priming with 2% N: P: K-

10:26:26 solution followed by foliar nutrition at pre flowing and 50% flowering stage with 2% N: P: K-20:20:20 can enhance the growth and productivity of black gram.

Key words: Black gram, seed priming, foliar nutrition, growth, productivity.

Influence of nutrient omission on growth and productivity of *rabi* maize (*Zea mays* L.)

Padda Prasanth Kumar*, Tanmoy Shankar, Sagar Maitra, Masina Sai Ram

Department of Agronomy, M.S. Swaminathan School of Agriculture, Centurion University of Technology and Management, Paralakhemundi, Odisha, India

Corresponding author: 200805190010@cutm.ac.in

Abstract

Maize is one of the important cereal crops in India as well as the world. In south Odisha conditions, maize is grown prominently in *kharif* as well in *rabi*. Application of nutrients is one of the most effective means to improve the productivity of maize. So, to find the effect of different macronutrients on maize crop, an experiment with nutrient omission plot technique has been laid out during the *rabi* season of 2021 in Bagusala farm, M. S. Swaminathan school of agriculture, Centurion university of technology and management located at (23º39‟N latitude and 87º42‟E longitude). The soil of the research plot was slightly acidic with a pH of 6.3 and the texture of the soil is sandy clay loam. The experiment was designed in a completely randomized block design with eight treatments and three replications. The treatments of the experiment are as follows T_1: $N_{100}P_{100}K_{100}$ (Ample dose), T_2:$N_0P_{100}K_{100}$, T_3:$N_{100}P_0K_{100}$, T_4:$N_{100}P_{100}K_0$, T_5:$N_{100}P_0K_0$, T_6:$N_0P_{100}K_0$, T_7:$N_0P_0K_{100}$ and T_8:$N_0P_0K_0$ (Control). The maize hybrid is suphala seeds sharp and the spacing was 60cm and 25cm, row to row and plant to plant respectively. The effect of nutrient omission in maize significantly affected both growth and yield parameters of maize. The treatment $N_{100}P_{100}K_{100}$ (T_1) resulted in maximum plant height (204.3 cm), dry matter accumulation (1648.4g/m^2), leaf area Index of (5.2), number of grains per cob (326.6) and highest grain yield (6.3 t ha^{-1}) and harvest index (44.3). The treatment

$N_{100}P_0K_{100}$ (T_2) and $N_{100}P_{100}K_0$ (T_3) also obtained similar growth and yield attributes and it was at par with T_1. Further, the omission of two or more major nutrients i.e., T_5, T_6, T_7 and T_8 (N, P and K) has resulted in the least performance in all growth and yield attributes of maize. The yield enhancement in the omission treatments is in the order of NPK>NP> NK>PK>N>P>K>Control. This shows that the application of nitrogen is very crucial for the maize crop for maximizing productivity and growth also the application of other two major nutrients (P and K) further enhance the yield of maize.

Influence of Phosphorous and Sulphur levels on Growth and yield of *summer* Sesame (*Sesamum indicum* L.)

Thandra Bhavana, Tanmoy Shankar, Sagar Maitra, Masina Sai Ram

Department of Agronomy, M.S. Swaminathan School of Agriculture, Centurion University of Technology and Management, Paralakhemundi, Odisha, India

Abstract

A field experiment was conducted during *summer* season of 2021 at Experimental Farm (Bagusala), M.S. Swaminathan School of Agriculture, Centurion University of Technology and Management, Parlakhemundi, Odisha. The experiment was done to observe the influence of phosphorus and sulphur on growth and yield of the crop sesame. The experiment was laid out in split-plot design with comprising of four levels of phosphorus (0, 30, 60, 90 kg P_2O_5 ha^{-1}) and three levels of sulphur (0, 20, 40 kg S ha^{-1}) which is replicated thrice and consisting of total twelve combination treatments. The sesame variety taken for experiment is YLM-17 with a seed rate of 3 kg/ha and spacing of 30×10cm. The results revealed that the application at 60 kg P_2O_5 ha^{-1} registered maximum growth attributes and yield parameters i.e., capsules $plant^{-1}$ (31.41), seeds $capsule^{-1}$ (41.48) than the lower levels and it is being statistically at par with the 90 kg P_2O_5 ha^{-1}. The seed yield (771.91 kg ha^{-1}) and straw yield (2199.02 kg ha^{-1}) were attained highest by the application of 60 kg P_2O_5 ha^{-1}. Whereas the application of sulphur @40 kg/ha resulted in the maximum growth attributes, yield parameters and mainly the seed (639.64 kg/ha) and straw yield (2129.49 kg/ha) attained highest, the less yield was observed in control plot. Further, the treatment combination of 60 kg P ha^{-1} and 40 kg S ha^{-1} resulted significantly maximum

plant height (116.29 cm), dry matter accumulation (2999.70 g/m^2), no. of branches (6.33), capsules $plant^{-1}$ (32.45), seeds $capsule^{-1}$ (42.92), seed yield (796.40 kg/ha) and straw yield (2474.30 kg/ha) than the other treatment combinations. Thus, this study concludes that *summer* sesame can be grown with 60 kg P_2O_5 ha^{-1} and 40 kg S ha^{-1} for the better growth and yield.

Key words- Sesame, growth, yield, phosphorus, sulphur

Role of silicon in rice for productivity, grain quality and stress alleviation

Sandeep gawdiya

Division of agronomy, ICAR-Indian Agricultural Research Institute New Delhi

Email: sandeepagro78626@gmail.com

Abstract

Rice yields are either declining or stagnating in post green revolution era mainly due to imbalance in fertilizer use, soil degradation, mono-cropping and lack of suitable rice genotypes for low moisture adaptability, insect-pest and disease resistance (Prakash, 2010). This has led to the depletion of many plant nutrients including silicon. Though being the 2nd most abundant element in the earth crust (28%), many soils contain an inadequate supply or are naturally low in plant available silicon. Highly weathered tropical and subtropical soils typically oxisol and ultisol under intensive rice cropping are generally low in available Si content due to weathering, heavy desilication and crop removal (Haynes, 2017). Silicon is considered as a beneficial element for healthy growth and development of rice crop (Liu et al., 2013) and absorbed in large amounts that are several-fold greater than those of the other macronutrients (Savant et al., 1996). Si strengthens the plant, protects the plant against pests and diseases, increases crop production and quality, stimulates active immune systems of plants, increases plant nutrition, increase plant salt resistance and neutralizes heavy metal toxicity in acid soils. Si fertilizer has a double effect on the soil–plant system. Through strengthens plant-protective properties and reducing metal toxicity (Rao et al., 2017). Jawahar et al, (2015) reported decreased dead heart and white ear percent

with different sources of silicon. In addition, silicon can enhance the grain quality of rice by reducing As (Gang *et al.* (2018) in grain and Pb content in rice plant (Gu *et al.*, 2011). Silicon can prove to be essential component in intensive rice cultivation under high nitrogen by preventing drooping of leaves and lodging of the plant. Rice is a silicon accumulator, so adequate attention should be given to silicon nutrition. Silicon management portfolio includes silicon fertilization and recycling of silicon in rice crop residues. Therefore, Silicon management is essential for sustaining rice productivity in tropical and subtropical soils.

Theme 7: Fisheries and Aquaculture

Growth response of Amur Carp reared at different salinity in Inland Saline region

Shashank Singh[*], A. K. Reddy[1] and P. P. Srivastava[2]

[*]School of Fisheries, Centurion University of Technology and Management, Paralakhemundi, Odisha

[1]Retd. Principal Scientist, ICAR- Central Institute of Fisheries Education, Mumbai, Maharashtra

[2]Registrar, Dr. Rajendra Prasad Central Agriculture University, PUSA, Samastipur, Bihar

[*]***Corresponding author:*** shashank.singh@cutm.ac.in

Abstract

Inland saline area has been identified as one of the new facets of aquaculture with immense potential and plethora of opportunities to be harnessed. India has about 8.7 million ha of inland saline soils and about 40% of these lands are prevailing in North- western parts of the country, where seasonal temperature changes are very high. Amur carp, *Cyprinus carpio haematopterus* is one of the species to tolerate wide range of temperatures. Keeping in view of prevailing environmental conditions, a 90 days experiment was designed to assess the growth of Amur carp (*Cyprinus carpio haematopterus*) in raw inland ground saline water (IGSW) of sub-humid and semi-arid/ arid zones of Haryana, India. Two hundred forty fishes (avg. wt. 3.48±0.272 g) were equally distributed in 4 treatment groups (control C, 0 ppt; T1, 5 ppt; T2, 10 ppt and T3, 15 ppt) with 3 replicates in 500 L tanks followed by complete randomized design (CRD). The physico-chemical parameters of water among different treatments were found in optimum range throughout the experimental period. The results indicated that the fish was able to survive up to 15 ppt in IGSW, whereas maximum survival and growth was observed up to 5 ppt of inland saline water. The digestive enzyme activity was significantly ($p<0.05$) affected by increasing salinity. The stress and immune responses were significantly ($p<0.05$) higher at elevated salinities. Based on the findings, it is suggested that Amur carp can be cultured with 100% survival up to 5 ppt with slightly lower production rate.

Aquaculture Intensification through Nutrient Recycling and Circular Economies

Nainsi Naya*

Department of Soil Science and Agricultural Chemistry
Indira Gandhi Krishi Vishwavidyalaya, Raipur, 492012 (C.G.), India

e-mail: naincy.naya@gmail.com

Abstract

Aquaculture has grown rapidly to play a crucial economic and social role and meet the increasing global demand for seafood. As aquaculture intensifies, there is increasing pressure to find more sustainable practices that save resources and reduce waste. Major wastes and by-products from aquaculture were quantified across a full range of farming types. Seafood by-products are a large and highly valuable resource, already being recycled for other uses, and there is potential to increase this further to benefit the aquaculture industry. By-products include damaged fish, body parts not usually utilized for direct human consumption, and trimmings from fish processing and canning. Aquaculture effluents are composed mainly of dissolved and settleable nutrients from unconsumed food and feces of farmed species. The amount and type of discarded material produced from aquaculture depends on factors including dietary supplementation, the metabolism and feeding habits of the farmed species, and consequently feed conversion efficiencies. Recycling of omega-3 fatty acids from seafood by-products and the use of bioremediating microalgae and filter-feeders (e.g. polychaetes, bivalves) can enable a large increase in the supply of omega-3 oils, with significant economic and human health benefits. Energy generated from sludge digestion, clean water retrieved from bioremediation, and upcycled nutrients through integrated aquaculture systems, could each help sustain intensive arable farming. The following recycling methodologies have the potential to play primary roles in establishing sustainable circular economies in aquaculture. Organic material discharge can also increase concentrations of pathogenic bacteria and viruses in water systems. Furthermore, extensive antibiotic usage in farm systems can accelerate the spread of disease resistant pathogens in receiving waters with detrimental impacts on aquaculture production.

Key words- aquaculture, bioremediating, industry, processing.

Advancement in Agriculture and Fisheries: Practices and management

Mansi Meena

Department of Agriculture, ITM University Gwalior, Madhya Pradesh, 474001

Email: mansi159meena@gmail.com

Abstract

Fish are aquatic, craniate, gill-bearing animals that lack limbs with digits. Included in this definition are the living hagfish, lampreys, and cartilaginous and bony fish as well as various extinct related groups. Around 99% of living fish species are ray-finned fish, belonging to the class Actinopterygii, with over 95% belonging to the teleost subgrouping. The earliest organisms that can be classified as fish were soft-bodied chordates that first appeared during the Cambrian period. Although they lacked a true spine, they possessed notochords which allowed them to be more agile than their invertebrate counterparts. Fish would continue to evolve through the Paleozoic era, diversifying into a wide variety of forms. In the study, production and capacity utilization rates and annual production of farms engaged in aquaculture in Turkey are determined. Turkey aquaculture production has reached 373356 tons in 2019. Of this production, 68.82% was produced in marine aquaculture and 31.18% was produced in the inland aquaculture. In Turkey, in 2019, 79.6% of the farms actively engaged in production was in inland and 20.4% was in the seas. It has been evaluated that 29.15% of the farms where 65.83% of the total fishery product needs are met in the Aegean Region. In aquaculture in Turkey, the total project capacity was determined to be 522778 tons. As is the case in production level and the number of farms, the highest capacity is 245894 tons in the Aegean Region, followed by the Black Sea Region with 75611 tons and Eastern Anatolia Region with 62349 tons. The project capacity utilization rates of the enterprises were 84.45% in the seas and 53.77% in inland, and it was determined as 71.42% in general. For fish as eaten by humans, see Fish as food.

Key words- Number of farms, aquaculture production, project capacity, project capacity utilization

Theme 8: Livestock Farming

Problems faced by farmers in animal husbandry practices in U.S. Nagar district of Uttarakhand

Shikha Yadav*[1], Anil Kumar[2] and CB Singh[3]

[1]Assistant Professor, Livestock Production Management, Doon PG College of Agriculture Science and Technology, Dehradun, Uttarakhand

[2]Associate Professor, G.B. Pant University of Agriculture & Technology Pantnagar, Uttarakhand, India

[3]Professor, G.B. Pant University of Agriculture & Technology Pantnagar, Uttarakhand, India

Abstract

The present study was carried out in U.S. Nagar district of Uttarakhand to find out the constraints faced by the farmers in animal husbandry practices. The data were collected through interview schedule from 180 farmers of five clusters. The major constraints in respect of feeding, breeding, and health care management practices were studied. Among animal husbandry practices, the major constraint in respect of breeding were unavailability of high genetic merit bull, insemination of animal at improper time, poor conception rate through A.I. As regards feeding of animals, main constraints were high cost of concentrate mixture, lack of knowledge about the proper amount of concentrate feeding. In respect of management of health care, lack of awareness about deworming schedule, lack of the knowledge of common contagious disease and their prevention measures and high cost of vaccination were found to be the most serious constraints.

Key words- Constraints; Animal Husbandry; Vaccination; Deworming

Livestock production and manure management of Goat: Practices and Enhancement

Harsh kumar sinha

Department of Agriculture Sam Higginbottom university of Agriculture, Technology and sciences, Prayagraj Uttar Pradesh, 211007

Email: hsinha022@gmail.com

Abstract

Goat (*Capra aegagrus hircus*), Lifespan: 15 – 18 years, Gestation period: 150 days, Mass: 20 – 140 kg (Adult), Trophic level: Herbivorous Encyclopedia of Life, Height: 41 – 58 cm (Adult, At Shoulder). The present study was formulated to assess the role of goats in augmenting farmers income. According to the availability of individuals belonging to weaker sections, four villages namely badohi, Azampur, Daraganj, Gagian and Kydganj of S.S. Block of Prayagraj were selected purposively for the study. Farmers belonging to scheduled caste category sustaining below poverty line were selected. The action research methodology clubbed with pretest-posttest research design was used for assessing the impact of goats in augmenting farmer's income. Two adult does of Beetal breed were provided to each of 32 selected beneficiaries along with one buck in each village for breeding purpose. The significant differences ($p<0.01$) in income level of farmers were observed even when the goats were kept on sub-optimal production conditions. Significant value of t-test suggested the significant increase of income by introduction of goats to the rural farmers. The study was concluded with the impression that goat rearing has significant effect in augmenting farmers'income. The basic demand was to doubling the farmer's income.

Key words- Beetal, Advancement, Farmers, Goats, Income, economy

Theme 9: Plant Protection

Potential distribution of fall armyworm, *Spodoptera frugiperda* in India under climate change by MaxEnt modelling

Maruthadurai. R* Bappa Das and R. Ramesh

ICAR (Indian Council of Agricultural Research), CCARI (Central Coastal Agricultural Research Institute), Ela, Old Goa, Goa, 403402, India

E-mail: duraiento@gmail.com

Abstract

Fall armyworm (FAW), *Spodoptera frugiperda* (J.E. Smith) (Lepidoptera: Noctuidae) is an invasive pest native to the Americas. The polyphagous pest has recently been introduced to India and rapidly spreading to all over the countries causing severe economic damage to maize and other fodder crops. The present study aimed to predict the potential distribution of FAW under present and future climate change scenarios in 2050 and 2070 under Shared Socioeconomic Pathway (SSP) 1-2.6 and SSP5-8.5 emission scenario with 19 bioclimatic variables through Maximum Entropy (MaxEnt) niche modelling. The Maxent model predicted the current and future distribution of FAW with a training AUC value of 0.940 and a test AUC value of 0.936 which indicating a better ability of the model for discrimination between suitable and unsuitable habitat areas for S. *frugiperda*. The model performed significantly better than random predictions. Jackknife test for estimating the predictive power of the variables showed that annual precipitation, annual mean temperature, and temperature seasonality were strongly influencing the distribution of fall armyworm. Under current climatic conditions, a highly suitable habitat for fall armyworm is mostly found in parts of Karnataka, Maharashtra, Andhra Pradesh, West Bengal, and Meghalaya. There is a significant increase in the highly suitable areas for fall armyworm under future climatic conditions and mostly detected in southern and central India. Maxent model predicted the highest risk of invasion and spread of FAW by 2050 and 2070 under SSP5-8.5 scenario. The predictions could be used to forecast the potential spread of FAW and combating outbreaks well in advance.

Key words- Fall armyworm, Invasive pest, Distribution, Climate change, Modelling

DNA barcoding as an effective tool for assessment biodiversity of arthropods: A review

Anil Kumar

Assistant Professor-cum-Scientist

Department of Entomology, Sugarcane Research Institute, Pusa, Samastipur, Bihar-848125

Email: agri_anil@rediffmail.com

Abstract

Arthropods are more diverse than any group of animals. There are nearly 10 million arthropods and 80 per cent of all known living animal species. A vast majority of arthropods is still undiscovered, which presents a major challenge for the taxonomists to discover and catalogue such a great diversity before they become extinct. Traditional taxonomy relies on morphology based taxonomic procedures which are time-consuming and may not always be sufficient for identification to the species level. Hence, a multidisciplinary approach to taxonomy is needed which comprises morphological, molecular and distribution data of the organism. DNA barcoding has emerged as a cost-effective standard for rapid species identification and has the potential to accelerate the discovery of new species and improve the quality of taxonomic information. The main taxonomic applications of DNA barcoding are identification of species previously defined by other criteria, description of new species and definition of operational units for ecological studies. At the same time, DNA barcoding can be done by non-taxonomist also. Hebert et al. (2003) proposed a universally accessible database of COI barcodes which utilizes a fragment of approximately 658 bp of the first half of the mitochondrial Cytochrome C Oxidase Subunit I gene, named COXI or COI. The use of a common DNA sequence, or a set of DNA sequences across a wide range of taxa with a uniform format for the submission, accession, and storage of tissues and information would greatly benefit the understanding of biodiversity. DNA barcodes have emerged as a handy tool during a critical period for taxonomy. Economic development and increased international commerce are leading to higher extinction rates and to the introduction of invasive and pest species. DNA barcoding can be done with any life stages of an organism, cryptic species and damaged specimens also. An approach utilizing DNA barcodes would provide a very

realistic, practical and flexible framework for species identification in the context of biosecurity.

Key words- Arthropods, DNA barcoding, biodiversity

Effect of Weather Parameters on Seasonal Incidence of Fruit Flies in Mango (*Mangifera indica* L.)

LHINGNEIVAH CHONGLOI*, S. N. DASH[1], TAKHELLAMBAM HENNY[2]

* Department of Fruit Science, College of Horticulture, Bagalkot, University of Horticultural Sciences, Bagalkot-587104, Karnataka, India

1 Department of Fruit Science and Horticultural Technology, College of Agriculture, Orissa University of Agriculture and Technology, Odisha, India.

2 Department of Floriculture and Landscape Architecture, College of Horticulture, KRCCH, Arabhavi

Abstract

Studies were conducted on the effect of weather parameters on the seasonal incidence of fruit flies in different varieties of mango during 2017 at OUAT campus, Bhubaneswar. Among the different varieties studied, Dashehari recorded a minimum trap catch of 11.50 adult fruit flies (20th standard week) and Totapuri a maximum of 104.25 trap catches (21st SW) followed by Suvarnarekha with a trap catch of 70.25 (19th SW) during their peak periods. The mean trap catch of all experimental SW was also highest in the variety Totapuri (51.43) followed by Suvarnarekha (42.00) while the lowest mean trap catches (6.69) was recorded in the Dashehari. The incidence of fruit flies had a high significant and positive correlation with both maximum and minimum temperature and significant negative correlation with morning relative humidity when monitored during the fruit development and maturity period. The mean number of maggot emergence per fruit was highest in Suvarnarekha (6.40) followed by Totapuri (6.10) and lowest in Langra (1.07).

Key words- *Bactrocera dorsalis*, Fruit fly, *Mangifera indica* L., Mango, Methyl Eugenol trap, Standard week

Ecological impact of Fusarium wilt caused by *Fusarium oxysporum* f. sp. *Udum*on pigeonpea

Bindhu, K. G[1*]., Yenjerappa, S. T[2]., Ajith kumar, K. Gururaj Sunkad[3]., Sreenivas, A. G.[4] and Mahadevaswamy[5]

College of Agriculture, UAS, Raichur

***Corresponding author*:** bindhukg77@gmail.com

Abstract

The fusarium wilt of pigeonpea is a soilborne disease which is influenced by the weather and other climatic factors. So, a detailed study was conducted on the ecology of Fusarium wilt during the year 2017 and 2018 at ARS, Kalaburagi. Ecological factors like temperature, RH, soil temperature, soil moisture, pH, rainfall were studied against the Fusarium wilt. When the correlation coefficient (r) values were assessed, there was a non-significant positive correlation between PDI, Maximum temperature (0.37), Minimum temperature (0.20) and soil temperature (0.44). Whereas, morning relative humidity (-0.72), evening relative humidity (-0.87), soil moisture (-0.82), rainfall (-0.72) and rainyday (-0.79) were significant and negatively correlating with PDI. Regression analysis of the cumulative wilt incidence indicated that amongst the multiple regression equations, a goodness of fit was best fitted for the equation. Y = 74.11 + 1.08 Temp (Max) + 0.64Temp (Min) + 0.37 R.H (A.M) – 0.73 R.H (P.M) – 1.50 (Soil temperature) - 0.38 (Soil moisture) – 0.10 (Rainfall) - 17.48 (Rainy day) 2017-18. While there was a non-significant positive correlation between PDI, Maximum temperature (0.40), Minimum temperature (0.23) and soil temperature (0.47). Whereas, morning relative humidity (-0.74), evening relative humidity (-0.89), soil moisture (-0.84), rainfall (-0.68) and rainyday (-0.75) were significant and negatively correlating with PDI (2018-19). Regression analysis of the cumulative wilt incidence indicated that amongst the multiple regression equations, a goodness of fit was best fitted for the equation for crop season 2018-19. Y= 69.20 + 1.00 Temp (Max) + 0.42 Temp (Min) + 0.35 R.H (A.M) – 0.72 R.H (P.M) – 1.19 (Soil temperature) - 0.42 (Soil moisture) – 0.01 (Rainfall) - 15.22 (Rainy day). From these studies it is said that optimum moisture content, relative humidity, rainfall and temperature are essential for the growth of the pathogen.

Biodiversity of soil mesofauna and role of oribatid mites in crop productivity in Wheat-Green gram-Rice cropping system under the Gangetic basin of West Bengal, India

Shamik Dey[1*], Tufleuddin Biswas[2], Krishna Karmakar[3]

1. School of Agricultural Sciences, JIS University, Agarpara- 700109, West Bengal, India.

2. Dept. of Agricultural Economics and Statistics, MS. Swaminathan School of Agriculture, Centurion University of Technology and management, Odisha-761211.

3. Department of Agricultural Entomology, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur- 741252, Nadia.

[*]***Corresponding author:*** deyshamik93@gmail.com

Abstract

The present experiment was carried out in Balindi Research Complex Farm, Bidhan Chandra Krishi Viswavidyalaya during 2018-2019 and 2019-2020. The entire field was divided into three tillage systems viz. Conventional tillage (CT), Zero tillage (ZT) and Reduced tillage (RT) depending on the tillage intensity. Each tillage plot was further subdivided into five different nutrient residue combinations. From the Wheat crop, highest mesofauna diversity value (1.72) and (1.74) was obtained from RN5 and RN3 during 2018-2019 and 2019-2020. In Green gram, highest value (1.72) and (1.75) was recorded from RN4 among the fifteen treatments during 2019 and 2020. In Rice crop, among the fifteen treatments, RN3 (Reduced tillage with 100 % paddy straw residue + 75 % N.P.K) followed by ZN3 (Zero tillage with 100 % paddy straw residue + 75 % N.P.K) showed the best result in terms of providing the maximum value of Shannon-Wiener Index (1.75) and (1.73) respectively and lowest value (1.56) was obtained from CN2 (Conventional tillage with 100 % paddy straw residue + 50 % N.P.K) during 2018-2019 and 2019-2020. The impact of oribatid mites in crop productivity was significant. The correlation between grains per panicle and oribatid mite population was positively significant (0.952*) during 2019-2020 in reduced tillage system in Wheat cultivation. Correlation value between grains per panicle and oribatid mite population was positively significant (0.929*) in conventional tillage during 2020 and correlation value between panicles per plant and oribatid mite population

was positively significant (0.942*) and (0.880*) in zero tillage during 2019 and 2020 in Rice crop.

Key words- Conventional tillage; Zero tillage; Reduced tillage; Mesofauna; Productivity.

Impact of *Trichoderma* spp. on Growth Dynamics of Soybean

Priya Singh[1] and Inkresh Kumar Verma[1]

[1]Department of Plant Pathology and Nematology, Dr. Rajendra Prasad Central Agricultural University, Pusa, Samastipur, Bihar

Abstract

Trichoderma are ubiquitous soil inhabitant and saprophytic fungi. They are well known for their ability to suppress plant pathogens as well as growth promoters of various crops. In the present study, effect of fifteen isolates of *Trichoderma* obtained from Pantnagar and Dehradun was investigated on growth parameters of soybean by seed coating, soil application and foliar application of *Trichoderma*. The spores powder of *Trichoderma* @ 10 g per kg seed for seed treatment, soil application @ 10 g per 2 kg pot and foliar spray of 10 g per lit. was carried out. The *Trichoderma* treated seeds (ten) were planted in pots in which *Trichoderma* spores was already applied to soil while, foliar spray of *Trichoderma* spore suspension was done at 15 days after sowing. The maximum germination percentage (96.67 %) was reported in case of isolate PT-10 (Pantnagar), DDNT-4 and DDNT-5 (Dehradun) at par with each other. The highest shoot length was observed for the isolate DDNT-4 (34.50 cm) followed by PT-10 (33.00 cm) while least for the isolate PT-3 (21.5 cm). In case of root length, highest was recorded with isolate PT-5 (19.00 cm) followed by DDNT-4 (18.50 cm) and DDNT-2 (18.00 cm). The minimum root length was observed for the isolate PT-1 (12.50 cm) which was at par with PT-8 (12.50 cm) but significantly better than control (9.00 cm). The isolate DDNT-4 (5123.51) exhibited the maximum vigour index which was followed by PT-10 (4736.83). These two isolates have the potential to increase the growth dynamics of soybean plant and can be exploited in future if further research is carried out in these aspects.

Screening of parthenocarpic cucumber (*Cucumis Sativus* L.) lines for resistance to Powdery mildew

Yashpal Singh Bisht and D. K. Singh

Department of Vegetable Science, College of Agriculture,
G. B. Pant University of Agriculture and Technology, Pantnagar

Abstract

Cucumber (*Cucumis Sativus* L.) is one of the major tropical and subtropical summer vegetable belonging to family Cucurbitacea having chromosome number 2n=2X=14. Cucurbits are highly susceptible to several biotic and abiotic stresses. The first requirement of resistant breeding is to find out the resistance sources. The resistance sources are generally present in landraces and wild relatives. In cucumber, resistance to powdery mildew (*Golovinomyces cichoracearum* and *Podosphaera xanthii*) is found in PI 200815, PI 200818, *Cucumis hardwikkii*, Wise 2757 (USA). The application of fungicide to control will partially control powdery mildew. Disease resistance from introduced germplasm has been a long valuable tool to control powdery mildew. With these point in mind an experiment was conducted at Vegetable Research Centre, G. B. Pant University of Agriculture and Technology, Pantnagar for screening of suitable parent for development of resistant variety/hybrid for higher production. Ten lines *i. e.* Pant Parthenocarpic Cucumber-2, Pant Parthenocarpic Cucumber-3, PPCUC-4, PPCUC-5, PPCUC-6, PPCUC-8, PPCUC-9, PPCUC-10, PPCUC-11, PPCUC-12 and three testers *i. e.* PCUC-8, PCUC-28 and PCUC-51 were crossed in first season to develop 30 F_1's. In next season, thirty F_1's along with parents are were evaluated in RBD with three replications. Result showed that PPCUC-3×PCUC-28 is best among 30 F_1's and 13 parents when compared with resistant check Pointsette, whereas PPCUC-5×PCUC-51 is susceptible among all. Within parent, Pant Parthenocarpic Cucumber-3 is resistant and PPCUC-5 is most susceptible. Therefore, Pant Parthenocarpic Cucumber-3 can be used as a parent for development of resistant variety/hybrids.

Key words- Cucumber, Hybrids, Parthenocarpic, Powdery Mildew, Resistance

Yellow mosaic disease of greengram: causes and management scopes

Minakshi[1]*, Nita Lakra[2] and Rajesh Yadav[3]

[1.] Department of Botany and Plant physiology, COBHS, CCS Haryana Agricultural University, Hisar 125004, India

[2.] Department of Molecular biology, Biotechnology and Bioinformatics, COBHS, CCS Haryana Agricultural University, Hisar 125004, India

[3.] Pulses section, department of genetics and plant breeding, COA, CCS Haryana Agricultural University, Hisar 125004, India

Email: yadavminakshi1995@gmail.com

Abstract

Yellow mosaic disease stays a significant limitation on mungbean production as it may lead upto 85% yield loss depending upon severity of the infection. Regulation and management of this hazardous disease is the greatest task as of now. Hence, tracing down ways to manage yellow mosaic disease (YMD) including development of mungbean yellow mosaic virus (MYMV) resistant mungbean varieties is of prime importance. YMD resistance can be characterized using physio-biochemical and molecular approaches. In this review we discussed different begomiviruses and whitefly species responsible for YMD and implication of different management strategies against YMD such as use of resistant varieties, vector management, pathogen derived resistance, mutation breeding, wide-hybridization and marker assisted selection. The possibilities of utilizing different emerging tools such as CRISPR/Cas9 for gene editing and translational genomics are also discussed.

Key words- begomoviruses, gene editing, greengram, vector management, yellow mosaic disease

Physico-chemical basis of resistance in banana germplasms against banana leaf and fruit scarring beetle Nodostoma subcostatum (Jacoby) in Terai Region of West Bengal

Fouzia Bari*[1], S. K. Senapati[2], Nilanjana Chaudhuri[3] and Shriti Moses[4]

[1]Fouzia Bari, Ph.D. Research Scholar, Department of Agricultural Entomology.
Uttar Banga Krishi Vishwavidyalaya, Cooch Behar. West Bengal 736165.

[2]S. K. Senapati, Professor, Department of Agricultural Entomology
Uttar Banga Krishi Vishwavidyalaya, Cooch Behar. West Bengal 736165.

[3]Nilanjana Chaudhuri, Assistant Professor, Department of Agricultural Entomology
Uttar Banga Krishi Vishwavidyalaya, Cooch Behar. West Bengal 736165.

[4]Shriti Moses, Ph.D. Research Scholar, Department of Agricultural Entomology.
Uttar Banga Krishi Vishwavidyalaya, Cooch Behar. West Bengal 736165.

Abstract

The field experiment entitled "Physico-chemical basis of resistance in banana germplasms against banana leaf and fruit scarring beetle *Nodostoma Subcostatum* (Jacoby) in Terai Region of West Bengal" was conducted at Horticulture Research Farm of Uttar Banga Krishi Vishwavidyalaya during 2018-19 and 2019-20. Ten local banana cultivars were selected with respect to characters such as leaf infestation, cuticular thickness of leaves, number of scars on leaf, leaf length and breadth chlorophyll and phenolic content among selected germplasms. The experimental analysis revealed that in both years i.e. 2018-19 and 2019-20, the local cultivar Red Banana and Thorachara were highly resistant with lowest leaf and fruit infestation followed by Monua respectively, whereas the cultivar G_9 and Malbhog and was observed extremely susceptible with maximum Leaf and fruit infestation followed by Amrit Sagar respectively. The overall contribution of morphological and biochemical character observed towards the identification of physico-chemical bases of resistance against Banana Leaf and Fruit Scarring Beetle *Nodostoma Subcostatum* (Jacoby) was obtained significant in combination of all morphological and biochemical characters among germplasms including cuticular thickness of leaves, number of scars produced by Scarring Beetle on leaf, leaf length and breadth.

Key words: Infestation, Cultivar, Resistance, and Scars.

Predicting climate change impact on the potential geographical distribution of onion thrips, *Thrips tabaci* in India using maximum entropy ecological niche modeling

V Karuppaiah[*1]., R. Maruthadurai[2]., B. Das[3]., P.S. Soumia[4]., V. Mahajan[5] and M. Singh[6]

[1,4,5,6] ICAR-Directorate of Onion and Garlic Research, Rajgurunagar, Pune-410505, Maharashtra

[2,3] ICAR-Central Coastal Agricultural Research Institute, Ela, Old Goa-403402, Goa

Corresponding Authors Email: karuppaiahv2008@gmail.com

Abstract

Climate change is projected to have a significant impact on species distribution, severity, and invasion of insect pests. Onion thrips, *Thrips tabaci* Lindeman (Thysanoptera: Thripidae) is an economically important pest of onion in India, causing significant yield loss. Under changing climate change scenarios, predicting a species potential distribution of a pest species is critical for understanding its future distribution scenario and early planning of control strategies. We used MaxEnt niche modeling with nine most relevant climatic variables and species occurrence data to predict the potential distribution of *T. tabaci* in India. The projections for future scenarios SSP1-2.6 and SSP5-8.5 demonstrate that annual mean temperature (Bio1) and annual precipitation (Bio12) is the most influencing bioclimatic variable for geographical distribution of *T. tabaci*. The suitability maps show that central and southern parts of India were highly suitable for current and near future habitat. An increase of highly and optimum suitability areas among some north Indian states were predicted under projections. Over all model suggesting a decrease in suitable habitable areas for *T. tabaci* in 2050 and 2070 with CMIP6 projection compared to current climatic conditions. These outcomes deliberate the future potential distribution of *T. tabaci*, along with a habitat suitability map for India, and provides a theoretical basis for climate change preparedness and long-term mitigation strategies for this destructive pest.

Black soldier fly - Future food and feed

Sravanthi Erla[1], Ph.D Scholar

[1] Department of Entomology, Professor Jayashankar Telangana State Agricultural University, Rajendranagar-500030, Telangana, India.

Email id: sravanthierla27@ gmail.com

Abstract

Black soldier fly (*Hermetia illucens*) (BSF) larvae have gained popularity both for their ability to decompose organic waste and serve as a source of proteins for domestic livestock. Food futurists accept that sustainability-minded humanity will increasingly incorporate insects as alternative protein. Treatment of organic waste by using black soldier fly larvae is an environmentally safe and cost-efficient method that has been attracting increasing attention worldwide. Black soldier fly larvae decompose various types of organic waste and converts them into high-value biomasses such as oils and proteins. The larvae contain 42% crude protein and 29% fat, although they are higher in saturated fats than insects. For commercial use in human foods, larvae could potentially be milled and converted into a textured protein with a strong flavor. The biggest advantage over other insects is their ability to convert waste into food, generating value and closing nutrient loops as they reduce pollution and costs. This review may provide further directions of investigations including culture techniques for industrial scale applications of black soldier fly larvae in food waste treatment and resource production.

Key words- Decomposition, organic waste, biomass, bio-fuel, food, feed

Emergence of *Nigrospora* leaf blight as major biotic stress in south eastern coastal region of India

[1]Arnab Adhikary, [2]Siddhartha Das and [1]Aninda Chakraborty

[1]Department of Genetics and plant breeding, M.S. Swaminathan School of Agriculture, Centurion University of Technology and Management, Paralakhemundi, Odisha-761211, India

[2]Department of Plant Pathology, M.S. Swaminathan School of Agriculture, Centurion University of Technology and Management, Paralakhemundi, Odisha-761211, India

Email of corresponding author: siddhartha.das10@gmail.com

Abstract

Rice is considered to be the staple food crop in India. As per the latest statistics, rice cultivation has reached to 102.36 million tons in 2020-21 (as per 1st advance estimates DES (DAC & FW). The major rice growing states in India are Odisha, West Bengal, Uttar Pradesh, Punjab, Bihar, Chhattisgarh, Andhra Pradesh, Telengana, Assam and Tamil Nadu. Odisha gain the production of over 8 million metric tons in 2020. Though south eastern coastal belt of Odisha encircled with such a favorable environmental condition for rice growing but every year a heavy yield loss is occurring due to various biotic stresses. Prolonged survey among different districts of south eastern Odisha reflects that *Nigrospora* leaf blight turned to be a major biotic stress for rice cultivation. A severe disease incidence 45-60% with a critical blast like appearance makes the disease disappear by visual observation from other diseases. Typical symptomatic expression shows large eye shaped grayish patch encircled with brownish hallow. The present research describes identification of the causal pathogen as *Nigrospora oryzae* through molecular detection by ITS-r DNA sequencing technology with 99% identity with NCBI *Nigrospora* database. Optimum temperature ranges between 28±2° C coupled with 80-90% relative humidity triggers the disease and turn it to be a major biotic stress. To the best of our knowledge and review of literature this is first report of emerging trend and appearance of *Nigrospora* from south eastern coastal region of Odisha, India.

Key words- Rice, biotic stress, *Nigrospora*, Disease incidence

Species composition of predatory spider fauna in rice ecosystem in terai region of West Bengal

Shriti Moses*[1], Jaydeb Ghosh[2] Nilanjana Chaudhuri[3] and Fouzia Bari[4]

[1]Shriti Moses, Ph.D. Research Scholar, Department of Agricultural Entomology, Uttar Banga Krishi Viswavidyalaya, Pundibari, Cooch Behar, West Bengal-736165.

[2]Jaydeb Ghosh, Professor, Department of Agricultural Entomology, Uttar Banga Krishi Viswavidyalaya, Pundibari, Cooch Behar, West Bengal-736165.

[3]Nilanjana Chaudhuri, Associate Professor, Department of Agricultural Entomology, Uttar Banga Krishi Viswavidyalaya, Pundibari, Cooch Behar, West Bengal-736165.

[4]Fouzia Bari, Ph.D. Research Scholar, Department of Agricultural Entomology, Uttar Banga Krishi Viswavidyalaya, Pundibari, Cooch Behar, West Bengal-736165.

Abstract

The field experiment was conducted at the agricultural research farm of Uttar Banga Krishi Viswavidyalaya, Pundibari, Cooch Behar, West Bengal, India in 2019 to 2021 for the study of species composition of predatory spider fauna in rice ecosystem. The spiders' specimens were collected from respective rice field during separate kharif and rabi seasons and the samples were subjected to laboratory investigation for identification on the basis of morphological characters under stereo microscope in the Department of Agricultural Entomology, UBKV, Pundibari, Cooch Behar during the respective years of study. Sampling was done at different rice growth stages i.e. nursery, vegetative, reproductive and maturity stages. Among the identified spider species, it was observed that *Oxyopes lineatus* was the most prevalent followed by *Lycosa pseudoannulata*. The population of these species also varied at different growth stages of rice. The population of predatory spiders was found maximum at reproductive and maturity stage and the minimum was observed at nursery stage.

Key words- Rice, predatory, spiders, population

Ecological Engineering for Insect Pest Management

M. Satwika[1]

PhD. Scholar**,** Department of Entomology, Professor Jayashankar Telangana State Agricultural University, Rajendranagar, Hyderabad - 500030

Email id: satwikam23@ gmail.com, Mobile No: 9553020358

Abstract

Ecological engineering is an environmental manipulation by man using small amounts of supplementary energy to control systems in which main energy drives are still coming from natural sources given by Odum (1962). It employs the use of Ecosystem Services (ES) that exists in an Agro-Ecosystem for pest suppression. ES are the conditions and processes through which natural ecosystems and the species that make them up, sustain and fulfill human life (Daily, 1997). Key resources provided by Ecological Engineering are Shelter, nectar, alternative Host/Prey and Pollen. Ecological engineering methods includes provision of resources in cropping system by provision of resources in cropping system like organic soil amendments (EE below the ground), supplementary resources, Herbivore induced plant volatiles and Synthetic herbivore induced plant volatiles and by habitat management (EE above the ground). Attract and Reward strategy involves the application of synthetic HIPVs to attract natural enemies and flowering plants to maximize the fitness and performance of attracted natural enemies. Push pull strategy is a novel approach in pest management which uses a repellent intercrop and an attractive trap plant. Insect pests are repelled from the food crop and are simultaneously attracted to trap crop. Habitat management can effect the pest control by improving crop habitats for natural enemies, managing vegetation surrounding the field, increasing within – field crop diversity and by creating corridors for natural enemies. Benefits of ecological engineering: Reduces pesticide use, saves money (an option of low-cost pest management), reduces pesticide residues in farm products, render farm environment safe and healthy for humans and wildlife, enhances biodiversity and add value to the overall health and beauty of the farm.

Key words- Ecosystem Services (ES), Herbivore Induced Plant Volatiles (HIPV), Push Pull strategy, Ecological Engineering (EE).

MANAGEMENT OF ROOT AND COLLAR ROT (*Macrophomina phaseolina* (Tassi) Goid.) OF OKRA (*Abelmoschus esculentus* (L.) Moench) THROUGH BIOAGENTS, OIL CAKES AND FUNGICIDES

Aravind T[1*], A. B. Brahmbhatt[2], Shivani[3], Karibasappa CS[4] and Gaurav Rakhonde[5]

[1]Department of Plant Pathology, MSSSOA, Centurion University of Technology and Management, Odisha-761211

[2]Department of Plant Pathology, Anand Agriculture University, Anand, Gujarat-388110

[3]Department of Plant Pathology, G.B. Pant University of Agriculture and Technology, Pantnagar, Uttarakhand -263145

[4]Department of Plant Pathology, University of Agricultural Sciences Bangaluru, Karnataka- 560065

Corresponding author Email: aravindtherthala@gmail.com

Abstract

The *in vitro* evaluation of five different bioagents against *Macrophomina phaseolina*, incitant of root and collar rot of okra, revealed that *Trichoderma viride* was the most effective with highest growth inhibition (73.06%) followed by *T. harzianum* (68.89%). Among the oil cake extracts, neem cake extract had highest growth inhibition with 33.89 and 38.89 per cent at 10 and 20 per cent concentration, respectively. Among the different fungicides tested, tebuconazole had cent per cent growth inhibition at both concentrations followed by carbendazim 12% + mancozeb 63% with 89.63 and 91.86 per cent growth inhibition at 500 and 1000 ppm, respectively. Out of the eight different treatments tested *in vivo* through pot culture studies, seed treatment with *T. viride* combined with soil application of *T. viride* enriched FYM recorded the least mortality percentage (26.55%) and highest vigour index (1643).

Key words: Okra, Root and collar rot, Bioagents, Oil cakes, Fungicides

Broad Review on Mycotoxin Producing Fungi

Ravikiran Regeti [1] and Praveen Boddana*

[1]Department of Plant Pathology, M.S. Swaminathan School of Agriculture, Centurion University of Technology and Management, Paralakhemundi, Gajapati, Odisha, India.

[*] Department of Plant Pathology, M.S. Swaminathan School of Agriculture, Centurion University of Technology and Management, Paralakhemundi, Gajapati, Odisha, India.

Abstract

Most of the filamentous fungi are able to grow in food and feed produce toxic metabolites. Mainly occurs in grains,cereals, oilseeds and some by-products. The growth of fungi in a particular food & feed by a large series of physical and chemical parameters. These toxic secondary metabolits known as mycotoxins. The mycotoxin can cause toxic effects in humans, animals and economic losses. The major mycotoxins found in food and feed are the aflatoxins, fumonisins, ochratoxins, patulin, zearalenone, and trichothecenes, generally stable at high temperatures and long storage periods. The major groups of the mycotoxins in groups are produced by mainly three fungal genera: *Fusarium, Aspergillus* and *Penicillium*. The metabolites affect the seed quality, germination, viability, seedling vigour, growth of root and coleoptile. Fungi are responsible for the production of mycotoxins are often endophytes that will infect and colonize living plant tissues, accumulation of mycotoxins will show plant disease symptoms.

Key words: Filamentous fungi, Mycotoxins, Toxic metabolites, Food and Feed, plant disease

Effect of Weather Factors on Severity of Spot Blotch Disease in Wheat

Debjeet Sharma*[1] and Sunita Mahapatra[2]

*[1]Assistant Professor, Doon PG College of Agriculture and Technology, Selaqui, Dehradun, Uttarakhand

[2]Assistant Professor, Plant Pathology, BCKV, Mohanpur, West Bengal

Email: debjeet19@gmail.com

Abstract

Wheat being the 2nd most important staple food crop of India is confronted by various biotic and abiotic constraints that are causing a threat in its successful production. Among all the foliar diseases, spot blotch of wheat is prevalent in the Eastern part of India. The present investigation was carried out in the Balindi Research Complex under Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal, India, during the Rabi season 2020-21. *Bipolaris sorokiniana* is a seed, soil and stubble borne pathogen causing Spot Blotch of wheat worldwide, especially in the warmer parts of the country. It has been reported to affect wheat to an increasing rate thus decreasing the yield. The weather parameters like Temperature (Maximum and Minimum) and relative humidity had profound effect on the disease progress and severity of each of the five varieties of wheat viz. DBW 39, DBW 107, HD 2967, CBW 38 and DBW 187. With the increase in age of the wheat crop, temperature maximum (23.37 to 34.61 °C) minimum temperature (8.03 to 20.41 °C), relative humidity (87.45 to 99.57 %), there was an increase in disease severity in all the five varieties whereas DBW 39 was infected the least and CBW 38 was infected the most with spot blotch.

Key words: *Bipolaris sorokiniana*, Spot blotch, Wheat, Temperature, Relative humidity

In vitro and *In vivo* evaluation of biocontrol agents against Cotton *Alternaria alternata*

I Venkatesh[1] and Bhattiprolu, S. L[2]

1-M S Swaminathan School of Agriculture, Paralakhemundi

2-Regional agricultural research station, Acharya N. G. Ranga Agricultural University, Lam, Guntur- 522034, Andhra Pradesh

Email: iddumuvenkatesh@gmail.com

Abstract

Cotton 'king of fibre' or 'white gold' is incited by diverse fungal, bacterial and viral diseases. Of these fungal diseases, Alternaria leaf spot is one of the important diseases. It caused the considerable yield losses of 38% under favourable environmental conditions like high relative humidity, moderate temperatures and intermittent rains. Hence, we conducted experiment *in vitro* and *in vivo* using various isolates of biocontrol agents like *Trichoerma viride* (TNAU, PDBC), *Pseuomonas fluorescens* (CICR, PDBC) and *Bacillus subtilis* (PDBC) to check the pathogen. Among the evaluated biocontrol agents *In vitro*, *T. viride* (TNAU) showed minimum radial growth (19.3 mm) and maximum percent inhibition of 78.5% followed by *T. viride* (TNAU) isolate with radial growth and percent inhibition of 29.5 mm, 67.2% respectively. In filed evaluation also *T. viride* exhibited best result to check the Alternaria leaf spot with minimum percent disease index of 9.7% and highest benefit cost ratio of 1.38. From our studies conclude that biocontrol agents gave good results. Hence, we recommend biocontrol agents to the farmers to check the harmful plant diseases.

FORAGING BEHAVIOUR OF POLLINATORS ON CASTOR

Sudhanshu Bala Nayak*

[1] MSSSOA, Department of Entomology, Centurion University of Technology and Management, Paralakhemundi, Odisha

Corresponding author E-mail: sudhanshu.nayak@cutm.ac.in

Abstract

The present investigations were carried to determine the foraging rates of different castor pollinators, on two promising castor hybrids genotypes of Northern India at Research Area of Department of Entomology, CCS Haryana Agricultural University, Hisar, Haryana. The whole trial has been totally based on the behaviour of various bees in context of two castor hybrid namely GCH-7 and DCH-177. Experiment was conducted in a Randomized Block Design (RBD) with fifteen replications under observation. Comparative foraging rate data of different pollinators on the both cultivars indicated the presence of interspecific variation in flower visitation rates. Among the honey bees, *A. dorsata* (6.79 flowers/minute), *A. mellifera* (6.03), *A. cerana* (5.39), *A. florea* (5.07) were found to visit a greater number of flowers in comparison to other pollinators. Next to honey bees, the foraging rate of other pollinators decreases significantly. While other pollinators like *Vespa* sp., *X. iridipennis, M. lanata*, *Polistes* sp., *M. bicolor* and *Eristalinus* sp. visited relatively a smaller number of flowers *i.e.,* 3.37, 3.34, 3.02, 2.88, 2.84 and 2.33 in a single minute respectively However, the studied pollinators were little bit selective in choosing the castor hybrids and there were significant differences found regarding the foraging rates between two hybrids. Irrespective of pollinators, the mean no. of flowers visited by individual pollinators was 4.45 and 3.92 flowers per minute during the year 2018 and 2019 respectively. The year 2018 faces relatively more foraging rate (number of flowers visited per min) as compare to year 2019. Among the pollinators, *A. dorsata* had the highest foraging rate while the *Eristalinus* sp. was having with lowest foraging rate.

Climate Change and Plant Pathogens: An Implication for Global Food Security

***[1]Bindhu K. G., Dr. Vanishree, S., Aravind Rathod, Zaheer Ahamed and Umesh Babu, S**

Agricultural Extension Education Center, Lingasugur, University of Agricultural sciences, Raichur

Correspondence Email: bindhukg77@gmail.com

Abstract

Climate change is the biggest threat to mankind, and is the cause of nearly 0.4 million deaths a year worldwide. The average global surface temperature has increased by 0.2°C per decade in the past 30 years. Consequently, several changes in the climate have been registered. The impacts of climate change can be positive, negative or neutral, since these changes can decrease, increase or have no impact on diseases, depending on each region or period. These impacts will also be observed on plants and other organisms as well as on other agro ecosystem components. Simultaneously, these changes will also affect the reproduction, spread and severity of many plant pathogens, thus posing a threat to our food security. Plant pathogens are ubiquitous in natural and managed systems, being among the first to demonstrate the effects of climate change due to the numerous populations, ease of reproduction and dispersal, and short time between generations. The importance of the environment on the development of plant diseases has been known for over two thousand years. The analysis of the potential impacts of climate change on plant diseases is essential for the adoption of adaptation measures, as well as for the development of resistant cultivars, new control methods or adapted techniques, in order to avoid more serious losses. Despite the threat posed by climate change to plant protection in the near future, This review aims to report and discuss the impacts of climate change on the spatial and temporal distribution of plant diseases, the effects of increased concentration of atmospheric CO2 and the consequences for disease control. The impacts on abiotic diseases associated with the occurrence of extreme values of environmental variables will not be discussed, in spite of an expected increase in their incidence

Theme 10: Post-Harvest Management

Management and Utilization of by- products and waste of vegetable in processing's industry

Bhupendra Kumar, Biplab Choudhari, Praveen Gupta, Saurabh Toppo and Garima Diwan

Department of Vegetable Science, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh

Abstract

Waste management includes collection, transportation, processing, recycling or disposal and monitoring of waste matters. It is important for protecting environment and public health. It is also used to recover value added products. Waste material generated from food processing and food service facilities can present treatment problems as they contain large proportions of carbohydrates, proteins, fat and mineral salts. Organic matter of the wastes must be subjected to biological stabilization prior to their disposal. It can be used in composting, cattle feeding and biogas generation and certain types may also be utilized in production of value added products. The present topic deals with the studies conducted on vegetable wastes for production of bio-fuel. Reducing food waste by complete utilization of resources creates good impact for the food security, economy, and the climate. With the incremental population, more food needs to be produced to fulfil the future demand. However, one-third of food produced is lost or wasted globally, and these wastes contribute to global climate change. Fruit and vegetables, are highly perishable biological materials contributed to the higher food waste compared to other commodity.

Key words- Waste management, recycling, organic matter, composting.

REPLACING PLASTICS IN HORTICULTURE WITH BIOPLASTICS FROM HORTI WASTE

AFIYA R S

Dept of Horticulture, Central University of Tamil Nadu, Neelakudy, Thiruvarur – 610005, Tamil Nadu, India

Email: afiyars20@students.cutn.ac.in

Abstract

In horticulture, plastics were used in various activities such as soil fumigation film, irrigation drip tape or tubing, nursery pots, silage bags, all kinds of plastic plant and soil coverings such as plastic mulch film, row coverings, high and low tunnels. Due to affordability, flexibility and easy manufacturing polyethylene is used in horticulture. Even in drying poly house multitier drier makes good use of modified micro climatic condition for drying of fruits and vegetable crops. Farmers are using products containing plastic to increase crop yields and improve the efficiency of water, agrochemical, and fertilizer use. Now this plastic can be replaced by bio plastics manufactured from horti waste. FPC(Fibre Particulate Composite) is a very versatile fibre-based composite material derived from horticultural waste capable of replacing the use of plastics, if products are made of 100% FPC, it's fully biodegradable and compostable; if products are made of combination of FPC and other plastics, in addition to effectively reduce the use of plastics, the FPC acting as a binding agent can also maximize the reuse of waste mixed-plastic where traditionally those can't be recycled, while creating value by making a better performance or quality product due to Up-cycling feature. The truly biodegradable feature can possibly foster the opportunity to rapidly increase the organic farming by converting the plastic-like FPCTM to organic fertilizer, a sustainable development example while reducing air pollution and creating values in a circular economy and cradle-to-cradle fashion. Pectin based bio plastics are made from apple pomace, cellulose based bio plastics from banana peels, pseudo stems, carrot waste, cassava peels, cauliflower waste, citrus waste, cocoa pod husks, hazelnut skin etc. Bio-plastics are made from waste materials – not from products intended for food production. This, combined with complete biodegradability in water, is the big environmental advantage.

Key words- plastics, bio plastics, horti waste

Differential Preference of Bruchids (*Callosobruchus* spp.) to Various Pulses During Storage

Vijaysingh Thakur*, C M Nawalagatti, M B Chetti, J S Hilli and R V Patil

University of Agricultural Sciences, Dharwad

***Corresponding author*:** vijay7607@gmail.com

Abstract

A storage experiment was conducted to know the storability of various pulses (greengram, moth bean, blackgram, chickpea and redgram) as influenced by different packaging materials such as cloth, gunny, HDPE and vacuum-packed bags and storage conditions such as ambient and cold storage (5-7 ºC temperature with 60 ± 2 % relative humidity) for 18 months. After 4 months of storage, infestation of greengram and moth bean seeds with bruchids were observed in cloth, gunny and HDPE bags under ambient condition only. Similarly, after 8 months of the storage, the seeds of blackgram, redgram and chickpea were also infested with bruchids in cloth, gunny and HDPE bags under ambient condition only due to differential pervious nature of packaging materials as cloth, gunny and HDPE bags being pervious in nature and vacuum-packed bags being impervious in nature. Further, no bruchids infestation were seen in any of the crop seeds even after 18 months of the storage in case of cold storage condition, as insects won't survive and multiply at low-temperature condition. Differential preference of bruchids to various pulses is because, seeds which are having smoother and lighter colour seed coat (greengram and moth bean) have been infested initially and which are of rougher and dark colour seed coat (blackgram, chickpea and redgram) have been infested later.

Standardization of optimum modified atmosphere packaging (MAP) conditions for extension of storage life and quality maintenance of guava under ambient conditions

Sachin A. J[1]*., D.V. Sudhakar Rao[1], and Ranjitha K[1], Vasugi C[2], Vijay Rakesh Reddy[1], Anusree Anand[1] and Karthik Nayaka V. S[1].

[1]Division of Postharvest Technology & Agricultural Engineering; [2]Division of Fruit Crops; ICAR- Indian Institute of Horticultural Research, Hesaraghatta, Bengaluru, Karnataka -560089, India

*_Email:_ sachin.iihr@gmail.com

Abstract

An experiment was conducted on guava fruits cv. Arka mridula to extend the shelf life by using different passive modified atmosphere packing (MAP) under ambient storage conditions. Fruits were packed in Polypropylene (PP 40 µm), low density polyethylene (LDPE 40 µm) and Cryovac® PD-961 (PD 31.5 µm) with and without micro-perforations along with a set of control fruits. Periodical observations on various physiological and biochemical parameters were recorded during storage of fruits. Modified atmosphere packaging at room temperature showed that polypropylene package was best packaging material to extend the shelf life of guava fruits. Non-perforated polypropylene pack (PP-NP) had maintained low O_2 and high CO_2 and fruits packed in them had low PLW, high firmness with better nutritional qualities and organoleptic preferences. At ambient storage conditions fruits packed in PP-MP had lower L* value with higher negative a* value and lower b* value at the end of the storage. Major biochemical attributes were retained by PP-NP and PD-NP packages with all the controlled physiological and biochemical processes PP-NP packed fruits recorded the lowest co-efficient of ripening (1.1) after seven days of storage at RT. Organoleptic evaluation showed the maximum scores for PP-NP and PP-MP packed fruits at the end of storage at room temperature and low temperature. Organoleptic evaluation of PP-NP packed fruits immediately after unpacking showed off flavour scoring and hence flavour profiling of PP-NP packed fruits was conducted which showed no off-flavour compounds in the fruit pulp.

Key words- Guava, MAP, Organoleptic scoring, quality, shelf life

Studies on Quality and Storability of Sapota Varieties Kalipatti and Cricket Ball Through Packaging Under Ambient Conditions

Nikhil Ankalagi*

[1]Department of Post-Harvest Technology, H H S S M S College of Horticulture, Malegaon Camp, Malegaon, Nashik

E-mail: nikhilca23@gmail.com

Abstract

The experiment on "Quality and Storability of Sapota Varieties Kalipatti and Cricket Ball Through Packaging Under Ambient Conditions" was conducted during the first week of May-2016-June-2016 in the department of Post-harvest Technology of Horticultural Crops, Faculty of Horticulture, Bidhan Chandra Krishi Viswavidyalaya, Nadia, to study the effect of treatments on quality of sapota fruits. The varieties of sapota Kalipatti and Cricket Ball was harvested at well matured stage. The sapota fruits were packed in different microns of LDPE packages (50 μ LDPE, 75μ LDPE, and 100 μ LDPE) placed in ambient condition whereas control was without packaging. All treatments were kept in ambient condition. The fruits were examined for physiological loss in weight (PLW), and organoleptic quality. While biochemical parameters *viz.*, TSS, Titrable acidity, TSS: Acid ratio, reducing sugars, and Total sugars were examined. The results revealed that var. Kalipatti fruits packed in 100μ LDPE followed by 75μ LDPE under ambient condition proved to be the best treatments among all the treatments which not only extended the shelf life and increased marketable fruits but also reduced the post–harvest losses without adversely affecting the fruit quality of sapota. Then, in var. Cricket Ball fruits packed in 75μ LDPE followed by 100μ LDPE under ambient condition proved to be the best treatments among all the treatments which not only extended the shelf life and increased marketable fruits but also reduced the post–harvest losses without adversely affecting the fruit quality of sapota. These treatments are found obviously easy for practical application for improving the quality of sapota fruits.

Key words- Sapota, Packaging, Low Density Polyethylene, Quality, TSS.

Influence of packing material and storage conditions on quality and sensory attributes of Palmyrah (*Borassus flabellifer* L.) tender fruit endosperm

Chandra Surya Rao M *[1], Swami DV [2], Ashok P[2], Salomi Suneetha DR[3], Sujatha RV [4] and Sekhar V[5]

Department of Horticulture[1], Centurion University of Technology and Management

[2, 3, 4&5]College of Horticulture, Dr. Y.S.R. Horticultural University

Venkataramannagudem, West Godavari, A.P – 534101

**** Corresponding author email:*** suryahorti97@gmail.com

Abstract

The study was focused to determine the effect of packing material and storage conditions on the physico-chemical changes that occurs during the storage life of the palmyrah tender fruit endosperm (nungu). The experiment was conducted in completely randomized factorial design with two factors at unequal levels and replicated thrice. LDPE 50 micron pouch, HDPE 50 micron pouch and aluminium foil pouch were the packing material and ice box, cold storage at 2^{o}C, cold storage at 4^{o}C and refrigerated storage were the storage conditions used during the period of investigation. During the storage the physico-chemical properties like total soluble solids, pH and reducing sugars followed an increasing trend upto 6th day. Whereas, this highest browning and titrable acidity content were recorded upto 8th day of storage. Significant difference for physico-chemical properties *viz.*, maximum total soluble solids (7.16^{o}Brix), reducing sugars (5.41%), minimum titrable acidity (0.418%) and browning (0.026%) were recorded when palmyrah tender fruit endosperm was packed in LDPE 50 micron pouch. Similarly, the maximum total soluble solids (8.94^{o}Brix), reducing sugars (5.39%), minimum titrable acidity (0.429%) and browning (0.028%) were recorded when palmyrah tender fruit endosperm was stored in cold storage at 2^{o}C. Superiority for sensory evaluation was reported for nungu packed in LDPE 50 micron and stored in cold storage at 2^{o}C upto the end of the shelf life *i.e.*, 8th day.

Key words- Palmyrah tender fruit endosperm, nungu, browning, shelf life

Green extraction of bioactive compounds from citrus peels and their use in the formation of nanoemulsions

Anuradha Saini[1,2]* and Parmjit Singh Panesar[1]

[1]Department of Food Engineering and Technology, Sant Longowal Institute of Engineering and Technology, Longowal, Punjab 148106, India

[2]Amity Institute of Biotechnology, Amity University Rajasthan, Jaipur 303002, India

E.mail: anuradha2108504@gmail.com

Abstract

Waste reduction by extracting bioactive compounds is the current interest of the researchers, government as well as industrial bodies from the last two decades. Due to the high production of citrus peels waste after processing across the world, the extraction of bioactive compounds using green extraction techniques is the sustainable and environmentally friendly approach. As compared to the conventional methods, green extraction techniques having the various techno-economical benefits such as desirable quality, cost effective, higher yield etc. Moreover, recovered bioactive compounds from citrus peels can be used in the formation of nanoemulsions for the development of effective antimicrobial and antioxidant agents.

Key words- Citrus peels, Green extraction, Bioactive compounds, Nanoemulsions

Waste utilization of Dragon fruit

[1]Prashant Kalal, [2]Deep Lata, [2]Karthik Nayaka V S, Divya Vani Vaka

[1]Division of Fruit Crops, [2]Division of PHT&AE

ICAR-IIHR, Bengaluru-560089

Author Email: prashantskalal691@gmail.com

Abstract

An increasing area and production of dragon fruit in the country due to its appealing color and nutritional value. Fruit is becoming more popular as a result of its numerous health-

promoting features, and because of its reduced sugar level in the pulp, it is a highly recommended fruit for diabetes patients. The fruit peel can be used as various useful products to reduce organic waste accumulation. It contains a higher bioactive compound mainly betalains and phenolic compounds than pulp which is also used as a natural colorant, antioxidant and antibacterial against food pathogens. Organic compounds present in the fruit peel have the ability to reduce the metal salt ion which can be used in the synthesis of metal (silver) nanoparticles. Peel extract can also be used as a meat preservative as an alternative to carcinogenic compounds nitrite and nitrate. Mucilage extracted from the peel is used as a flocculant for treating wastewater and in sausage industries as a food additive. Nowadays, the reuse of agricultural wastes is a major challenge in the research field. It is necessary to use dragon fruit peel efficiently on a commercial basis for multipurpose applications. Therefore, the use of fruit peel as a substitute for synthetic food color and preservatives is an environmentally friendly option.

Key words- Fruit peel, Bioactive, Preservative, Organic

Theme 11: Remote Sensing and Agricultural Meteorology

IMPACT OF CLIMATE CHANGE IN ORNAMENTAL CROPS

Sudati Akshitha[1] Maraboina Sandhyarani[*]

[1]Ph.D Scholar (Floriculture and Landscaping Architecture), Sri Konda Laxman Telangana State Horticultural University, Rajendranagar.

[*]Ph.D. Scholar (Fruit science), Dr. Y. S. R Horticultural university, College of Horticulture, Venkatramannagudem.

Author mail I'd: sudatiakshitha544@gmail.com

Abstract

Climate change refers to the variation in the Earth's global climate or in regional climates over time. United Nations Framework Convention on Climate Change (UNFCCC) defines climate change as "a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods." The Climate change affects directly or indirectly the agricultural activity including crops, soils, livestock and pests. Due to global warming, it interacts with habitat loss and fragmentation, introduced and invasive species and population growths and many ecosystems are likely to undergo severe modification. The climate change is the increase in the atmospheric temperature due to enhanced levels of greenhouse gases (GHGs) i.e., CO_2, Methane (CH_4) and nitrous oxide (N_2O) in the atmosphere. Environmental factors that affect plant growth include Light, Temperature, Carbon dioxide and Humidity. Some flowers fail to bloom, others will produce flowers of smaller size, improper colour development and shorter blooming period due to climate change and the production of flower crops which are grown in open field conditions like marigold, gladiolus, tuberose, rose, annuals will also be affected by climate change production. Other ornamentals such as orchids, rhododendrons, balsam which needs frost and low temperature for flowering are adversely influenced. The higher ambient temperature can have direct impact on volatile fragrances that the flowers emit, deterioration of pigments leading to dull shades. Changing pattern in photoperiodism and thermo-periodism would greatly alter the flowering pattern in flowers such as chrysanthemum, poinsettia and carnation. Climate change is major threat to pollination

services and there is a need to conserve plant communities and due to shift in insect pest and disease outbreaks, absence of winter chilling will reduce flowering, reduced post-harvest life, poor pollination and seed set. Hence to mitigate the effects o climate change roof gardening, vertical gardening, lawn development, indoor gardening, public parks, industrial gardens should be developed.

Key words- Climate change, Greenhouse gases, Environmental factors, pollination

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