MAHATMA GANDHI UNIVERSITY

IUCOFSA
INTER UNIVERSITY CENTRE FOR ORGANIC FARMING & SUSTAINABLE AGRICULTURE

ABSTRACT OF PAPERS

INTERNATIONAL SEMINAR ON EMERGING TRENDS IN ORGANIC FARMING AND SUSTAINABLE AGRICULTURE

29-31 DECEMBER 2016

MAHATMA GANDHI UNIVERSITY
KOTTAYAM, KERALA, INDIA

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Schedule

DAY I (29/12/2016) THURSDAY

8.30 am - 9.30 am	:	Registration & Tea	
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11.00 am - 11.20 am	:	**Keynote II** Current Status and Future Outlook of Organic Conservation Tillage in the U.S. Great Plains Region **Shabeg Briar** Montana State University, Central Agricultural Research Center, US	15
11.20 am – 11.30 am	:	**Paper Presentation – I** Settling and Ovipositional Preference of Whitebacked Planthopper, *Sogatella furcifera (Horvath)* on selected Rice Genotypes **K. Chandrasekar** Bihar Agricultural University, INDIA	24
11.30 am - 12.30 noon	:	**SCIENTIFIC SESSION II** Carbon Sequestration	
11.30 am – 11.50 am	:	**Keynote III** Organics in 3D: diversity, dynamics and development of organic agriculture **Stéphane Bellon** INRA, France	16
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12.10 pm - 12.20 pm	:	**Paper Presentation – III** Intercropping of vegetable crops under Ailanthus excelsa based agro forestry system **G.V. Rajalingam** Horticultural College and Research Institute, TNAU, Coimbatore – 3, Tamil Nadu.	26
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12.30 pm – 12.50 pm	:	**Invited Talk I** Are we ready for Organic Farming? Signals from field in Kerala and Strategies for future **P. Indira Devi** Kerala Agricultural University, India	19
12.50 pm – 1.10 pm	:	**Invited Talk II** Challenges in managing mineral nutrition of crop plants: Nutrient imbalance-interaction-availability-uptake-translocation-retranslocation and utilization **Bhupinder Singh** ICAR-Indian Agricultural Research Institute, India	20
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1.20 pm – 1.30 pm	:	**Paper Presentation – VI** Iron nutrition of rice in the era of sustainable agriculture **Abin Sebastian** University of Hyderabad, Hyderabad, INDIA	30
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2.30 pm – 3.10 pm	:	**SCIENTIFIC SESSION IV** Organic Farming & Soil Mineral Nutrients	
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2.50 pm – 3.00 pm	:	**Paper Presentation – VII** Bioprospecting for plant growth promoting *Bacillus* from semi-arid tropics **N.K. Singh** S.D. Agricultural University, India	31
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4.00 pm - 4.10 pm	:	**Paper Presentation – X** Fermented Foods: A microbial Approach for amelioration of Health Related issues **Dr. Suvarna** **V. Chavannavar** UAS, GKVK, INDIA	34
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4.20 pm – 4.30 pm	:	**Paper Presentation – XII** Exploitation of potentials of organic fruit production in North East India **Utpal das** Assam Agricultural University, India	36
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9.20 am - 9.40 am	:	**Invited Talk-III** Organic Fruit Production in North-east India: Concerns, Strategies and Priorities **T. K. Hazarika** Mizoram University; INDIA	51
9.40 am - 9.50 am	:	**Paper Presentation XIV** Bio efficacy of some commercially available eco-friendly insecticides against diamondback moth, *Plutella xylostella l.* in cabbage **M Vignesh** University of Agricultural Sciences, INDIA	58
9.50 am – 10.00 am	:	**Paper Presentation XV** Insecticide resistance management through use of entomopathogenic fungi *Metarhizium anisopliae (metch.)* against *Nilaparvata lugens* (stal) in rice **C. Mohan** Tamil Nadu Agricultural University, INDIA	60
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10.30 am - 10.50 am	:	**Invited Talk-V** Sustainable Animal Agriculture through Organic Farming and IPM for complementing the concept of holistic one health approach **B W Narladkar** College of Veterinary & Animal Sciences, MAFSU, INDIA	53
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11.50 am – 12.00 noon	:	**Paper Presentation – XX** Yield and economics of ginger influenced by different management systems **Thankamani CK** ICAR-Indian Institute of Spices Research, Kozhikode, INDIA	67

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12.00 noon - 1.00pm	:	**Keynote VII cum LEC DEM** Sustainable Organic Agriculture Systems along with Fair Trade in India, Africa and Europe **Rudolf Bühler** Ecoland International, Germany	43
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2.00 pm – 2.20 pm	:	**Invited talk VI** Eco-friendly approaches to manage insect pests of Indian Sandalwood (*Santalum album Linn.*),in the present scenario of its cultivation **R. Sundararaj** Institute of Wood Science & Technology, Bangalore, India.	55
2.20 pm - 2.30 pm	:	**Paper Presentation –XXI** Seed invigoration with organic preparations for accelerated germination and vigour in bhindi (*Abelmoschusesculentus (L.) Moench*) **Poornima Yadav** Kerala Agricultural University, Sadanandapuram, Kerala, INDIA	69
2.30 pm - 2.40 pm	:	**Paper Presentation – XXII** Genetic assessment for yield and quality components under organic and conventional fertilizer managements in groundnut (*Arachis hypogaea L.*), **M.Shanthi Priya** S.V.Agricultural College, Tirupati, India	70
2.40 pm - 2.50 pm	:	**Paper Presentation –XXIII** Identification of tropical crop plants suitable for cultivation in Nedumbana Panchayat, Kollam district, Kerala based on the flowering plant flora of the Pazhangalam Muhurthy sacred grove **Alan Thomas S** Mahatma Gandhi University, INDIA	73
2.50 pm - 3.00 pm	:	**Paper Presentation XXIV** Management of Sigatoka leaf spot disease of banana through an integrated approach. **Susha S.Thara** College of Agriculture, Kerala Agricultural University, Thiruvananthapuram, Kerala	74

3.00pm - 4.00 pm	:	**SCIENTIFIC SESSION VI**	
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3.20 pm - 3.40 pm	:	**Keynote IX** Biopesticides and Practices for Protecting The Plants In Organic Farming from Insects and Diseases **Nutan Kaushik** TERI, New Delhi , INDIA	50
3.40 pm - 3.50 pm	:	**Paper Presentation – XXV** In vitro sensitivity of *Azospirillum lipoferum* and *Azotobacter chroococccum* to new rice herbicide – bispyribac sodium + metamifop **Sheeja K** Coconut Research Station, Balaramapuram, Kerala, India	75
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DAY 3 (31/12/2016) SATURDAY

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9.20 am – 9.30 am	:	**Paper Presentation – XXIX** Wisdom of the Earth: Ecosophy and Holistic Agriculture **K M George** (Kondothara) Chairperson Dr Paulos Mar Gregorios Chair, Mahatma Gandhi University, Kerala, India	80
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9.40 am – 9.50 am	:	**Paper Presentation – XXXI** Probiotics for organic aquafarming **Glindya Bhagya Lakshmi** Mahatma Gandhi University, Kerala, INDIA	82
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10.00 am - 4.00 pm	:	House Boat Cruise	
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Poster Presentations

1. Nutritive requirements for the vegetative growth of Shiitake mushroom (Lentinulaedodes (Berk.) Pegler) and its yield impacts on various agrowastes,

   Dr. Deepa Rani C.V, Dr. Lulu Das and Dr. Susha S.Thara
   Department of PlantPathology, College of Agriculture, Vellayani, Thiruvananthapuram, Kerala, 695522deepasajith_akd@yahoo.com

2. Effect of integrated Plant nutrient system on soil biological health in a red loam soil,

   B.Aparna and Sathyan.R.N.
   Assistant Professor, Department of Soil Science & Agrl Chemistry, College of Agriculture, Vellayani, Trivandrum- 695522, Msc (Student), Department of Soil Science & Agrl Chemistry, College of Agriculture, Vellayani, Trivandrum- 695522

3. Shelf life of liquid organic formulation

   ***Rameeza E. M., **Usha K. E,**
   *Research scholar, College of Horticulture, vellanikkara, **Professor (Agronomy), PPNMU, Kerala Agricultural University, Vellanikkara, Thrissur

4. Promises of endophytic Paraconiothyrium as a biocontrol agent

   Anisha C and Radhakrishnan E K*
   School of Biosciences, M G University, P D Hills, Kottayam, Kerala, India,
   *Corresponding author: radhakrishnanek@mgu.ac.in, Tel :+91-9847901149

5. Biocontrol and plant growth promoting traits shown by Serratia sp. ZoB 14 isolated from Zingiber officinale

   Aswani.R, Rohini Sabu, Jyothis Mathew, Radhakrishnan E.K.
   Corresponding author: radhakrishnanek@mgu.ac.in, Tel :+91-9847901149

6. Application of Endophytic Burkholderia vietnamiensis from Zingiber officinale Rosc. in Organic farming

   Rohini Sabu[1], and Radhakrishnan E.K[1]*
   School of Biosciences, Mahatma Gandhi University, P.D Hills P.O, Kottayam, Kerala, India - 686560., *Corresponding author - radhakrishnanek@mgu.ac.in

7. Pathogenicity of Indigenous Isolates of Metarhiziumanisopliae Metschnikoff (Sorokin) to Bhindi Leaf Roller Syleptaderogata Fabricius,

   Dr. K. Sudharma, Ms. Praveena A
   Department of Agricultural Entomology, College of Agriculture, Vellayani

8. An Economic and environmental benefits of biopesticides in paddy farms: A study in Alappuzha District of Kerala State

   Hilagavathi.M[1], Neethu Thomas[2] and K.R. Ashok[1]
   [1]Dept.of Agricultural Economics, TNAU, Coimbatore and Coconut Development Board, Odisha

Keynote 1

Development and challenges for organic agriculture and sustainable food systems in Europe

Angelika Ploeger, Prof. Dr. Dr. H.C. Mult.
Kassel University, Faculty for Organic Agricultural Sciences, Section of Organic Food Quality and Food Culture, Study Director of the Master Program International Food Business and Consumer Studies (IFBC) and the European Master Program Sustainable Food Systems (SusFoods)

Abstract

Observing the market for organic agricultural food products worldwide during the last 5 years it shows a continues growth. The Europeans spend 2014 26,1 billion • for organic foods 8% more in comparison to 2013. Within the EU the Swedish market grows for organic produce by 45%,Norway, the Netherlands and France show a growth more than 10%.

On average Europeans buy for 37• per person and year organic foods (EU-28 per person 47• per year). The Swiss consumersare spending 222• per person/ a, the Germans 97 • (7th place in Europe). The Danish organic food market is the leading one with 7.6% of the total turnover for food, followed by Switzerland (7,1% of the food market).

Considering the global development for organic food the US-market shows anenormous growth (doubling in the last 7 years). Five % of the total food expenditure is for organic food (2014:27,1 billion •). Canada is the 4th biggest organic market worldwide (2,73 billion •) after US, Germany and France. China follows on the 5th place (2013). Chinese consumers buy organic food for 2,43 billion •.

In such exploding markets, it is important to look which food items consumer buy produced organically and why they buy it (e.g. animal welfare, protecting environment, human health). For US and Canada organic fruits and vegetables are important (36% and 40% of the total market). The key note will present some details.

Important is the fact that US, Canada as well as some European states are not able to deliver the amount of organic foods they need from their own organic farms. They have to import basic organic foodstuffs (e.g. grain, fruit, vegetables, milk) and by this increasing e.g. the foodmiles and climate relevant gases emission.

This leads to the question of food quality and quality understandingby farmers´ associations, consumers and the definition according to EU- regulation of organic foods. According to the IFOAM principles of organic agriculture (health, ecology, fairness and care) it means healthy soil, plants, animals and humans, sustaining natural systems, respect and justice for all living beings and to safe the resources for the generations to come. Consumers expectations on organic food have been analyzed in Europe showing the most important attitudinal choice factors which include health concerns, environmental concerns, animal welfare, taste preferences and preferred origin of food. The definition of quality according to EU-regulation is not focused on the product itself but on the process of the product regarding the farming system (e.g. feed, animal husbandry, fertilization, plant protection), the processing (e.g. processing aids but not technologies) and packaging, taking into account the IFOAM principles and using methods such as e.g. Life Cycle Assessment (LCA).

The challenges for organic farming and sustainable food systems in future will be the revision of the EU- regulation (in process), new processing technologies (such as Nanotechnology), changes in consumers‘ expectations for organic foods (such as authenticity) and the demand for food security worldwide. ■

Keynote II

Current Status and Future Outlook of Organic Conservation Tillage in the U.S. Great Plains Region

Shabeg Briar
Montana State University, Central Agricultural Research Center, US

Crop production and soil quality benefits following adoption of conservation-tillage practices in conventional dryland agriculture are well documented. This has spurred interest among organic farmers and researchers in developing reduced tillage practices that can be used successfully on organic farms.However, achieving long-term, consistent weed control has been cited as a main obstacle preventing the widespread adoption of conservation-tillage systems by organic farmers in the U.S. Great Plains and Intermountain region, particularly when farm scale prevents hoeing and hand removal of weeds from fields. To fill this knowledge gap, crop scientists and farmers in the northern U.S. Great Plains have explored various strategies to reduce and even eliminate tillage completely when growing wheat (Triticumaestivum L. emend Thell.) and other field and horticultural crops. Cover crop mulch, grazing, acetic acid applications, and other practices have been used with varying levels of success at suppressing weeds in certified organic environments. In particular, Canada thistle (Cirsiumarvense (L.) Scop), field bindweed (Convolvulus arvensis L.), and other creeping perennial weed species pose particular obstacles to the continued use of conservation-tillage practices following the first two to three years of adoption, although annual weeds (e.g., downy brome [Bromus tectorum L.) and simple perennials (e.g., dandelion [Taraxacumofficinale Weber) can also become problems. We will summarize efforts to develop long-term, conservation-tillage systems in environments managed organically, discuss how emerging practices and technology may affect the ability of organic farmers to adopt these systems in the near- and intermediate-future, and discuss how successful adoption of conservation-tillage practices by organic farmers may revolutionize organic farming in the U.S. Great Plains and similar climatic regions globally. ■

Keynote III

Organics in 3D: diversity, dynamics and development of organic agriculture

Stéphane Bellon[1]
INRA, France ; Gilles Allaire[2] INRA, France [1] INRA, UR 767 F-84914 Avignon Cedex 9, France. stephane.bellon@inra.fr[2] INRA, US 0685 (ODR), F-31326 Auzeville, France

ABSTRACT

Together with its growing recognition, organic agriculture continues to evolve. In this paper, we address this evolution with two paradigms - decomposition and identity –in the perspective of organic development. Our viewpoint combines research in the agronomic and social sciences. The proposed approach is threefold. First, we show that the tension between the diversity and identity of organics is resolved by the adaptation of its frameworks, thus connecting organics framing and farming. Then, we account for the main recent dynamics in the organic sector and translate them into research and development challenges, while specifying the roles of institutions in such orientations. This is supported by a vision of organic food and farming as a "prototype" for sustainable agricultures, but also questioned by other proposals such as agroecology. Finally, we address three issues related with the development of organics: the opportunities to redesign organic systems instead of favouring steady states; the redefinition of the expected performances for an organic agriculture in keeping with societal expectations, including the provision of public goods; and the balances to maintain within the diversity of organics to scale it up. A challenge is to maintain innovative capacities while preserving organic identity. ■

Keynote IV

Pest control strategies in Organic Farming in mango -an overview

K. Usha
Division of Fruits and Horticultural Technology, IARI, New Delhi

Organic farming in mango is an ecological production management system that promotes and enhances biodiversity, biological cycles, soil biological activity and integrity based on minimal use of off-farm inputs and on management practices that restore, maintain and enhance ecological harmony.In India organic mango production is practiced only by individual entrepreneurs and NGOs in isolated pockets and is slowly gaining popularity due to increased acceptance by the consumers. Big challenge in organic mango orduction is timely control of several pests like hoppers, mealy bugs, stem bores, fruit flies and diseases like powdery mildew, anthracnose, sooty mould and mango malformation etc.that drastically reducefruit yield and quality. Some of the strategies that can be practiced to successfully control pests in organic mango production are discussed in this paper.

Strategies like fruit bagging prevent pests, especially fruit flies, from damaging mangoes and checks latex burns and fungal spots on fruits, improving the market appearance of the fruit. Yellow sticky traps attract small flying insect pests and help in delaying the build-up of pests and in reducing existing insect populations.Hanging pheromone traps among treeshelp in catching fruit flies and other pests. Wrapping a slippery plastic band around the lower trunk region will restrict the movement of the emerging mealy bugs from soil up the trunk to branches.Applying sticky bands at the upper end of tree trunks when the trees start flowering reduce migration of weevils to branches for egg laying.Natural enemies such as lady beetle larva, wasps, spiders, parasitic fungi, attack the maggots of fruit flies and predators such as rove beetles, weaver ants, spiders, birds and bats are very efficient in protecting fruit trees from pests, including fruit flies.Their presence and foraging activity hinders the fruit flies from laying eggs, resulting in reduced fruit fly damage. Foliar spray with pyrethrum solution,plant extracts like neem, garlic, chilli and tephrosia,spraying with 1 % soap solution with 1 % pure

alcohol, an application of paraffin oil (white oil) as a 3 % water emulsion and practices like removal of dead branches, leaves and infested fruits from the orchard can reduce the pest incidence. Dill, parsley, yarrow, zinnia, clover, alfalfa, parsley, cosmos, sunflower and marigold are flowering crops that attract the native wasp populations and provide good habitats for them. Growing these crops as intercrops can help in reducing the pest incidence.

Strong antifungal activity and optimal control of floral malformation was found in trees sprayed with concoction brewed from Datura stramonium, Calotropisgigantea, Azadirachtaindicaand cow manure at bud break stage and again at fruit set stage when compared with the control. All malformed buds and panicles completely dried and dropped two days after foliar spray with brewed tea, whereas in the control, the malformed panicles remained green and competed with the growing fruits for plant nutrients.Biological control of plant diseases through the use of antagonistic microorganisms has been considered as a viable alternate method to chemical control.Bio-pesticides such as Pseudomonas fluorescens, Verticilliumlecanii, Beauveriabassiana as foliar sprays, besides neem oil spray helps in controlling sevral fungal diseases.B. subtilis, gram positive bacteria showed greater potential to control mango malformation when compared with P. fluorescensa gram negative bacterium. Due to airborne nature of dissemination and infection of buds, foliar spray once before flowering and again at the time of flower bud initiation with B. subtilis reduced the extent of mango malformation.The study showed that protection of buds from infection when inoculums prevail is necessary to control the disease. The bacterial bioagent B. subtilis which showed promise to control mango malformation both under in vitro and in vivo conditions is environment friendly, nontoxic to humans and animal health as reported earlier and constitute an effective, economically viable and sustainable approach to control malformation in mango.After harvest, anthracnose and fruit fly damage can be controlled if the fruits are dipped in hot water at 55°C for 3-5 minutes. In acute cases, mildew, anthracnose and leaf spot diseases can be regulated with sulphur or copper preparations, which are allowed in organic farming. ■

Invited Talk I

Are we ready for Organic Farming? Signals from field in Kerala and Strategies for future

P. Indira Devi
Kerala Agricultural University, India

Farming methods that depend on chemical based technologies has been facing severe criticism, on account of the long term negative ecological and social impacts. Organic Farming (OF) is thus gaining popularity as a green technology for agricultural production while securing ecological balance. This paper tries to review the farm level production performance of cropsunder organic farming technology in the backdrop of food security concerns .It also discuss some of the challenges associated with this technology based on farm observations and suggests future course of action to facilitate better spread of the technology. The paper is drawn from a case study of certified /non certified organic farms and control group, conducted in Kerala, India .

Factors that challenge the adoption of green technologies include personal, social, political and ecological and policy related. The psychological barriers of individual farmers and group dynamics are the major factors that belong to the first group. The social behavior of waste disposal, peer group characteristics and neighborhood effects exert considerable influence. The policy support for the promotion of organic farming often does not facilitate efficient supply chains of organic inputs, certification and marketing of products The externalities associated with irrigation water quality, farm management in neighborhood farms and upstream areas restrict the quality of the produce and hinder certification requirements. Certification agencies are mainly in private sector only and the cost of certification is prohibitive for many farmers. The paper also address the knowledge and extension gaps in this area. Thepaper suggest important policy prescriptions for effective implementation of organic farming practices ,in general. ■

Invited Talk II

Challenges in managing mineral nutrition of crop plants: Nutrient imbalance-interaction-availability-uptake- translocation-retranslocation and utilization;

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Mineral nutrient deficiency in the soil and at the plant level is a serious production constraint. Deficiency of both macro and micro nutrients in cultivable lands are rampant and adversely impact the grain productivity and quality and human nutrition. Over exploitation of soils and non-judicious management of farm resources and farm practices have caused widespread nutrient imbalance which leads to nutrient unavailability for plant uptake despite its sufficient presence in the soil. Interaction between macro and micro nutrients may influence not only nutrient uptake but also their translocation, retranslocation and accumulation in the grains to facilitate biofortification. AM application and other organic farming practices help in maintaining balance between various nutrients and thus optimise nutrient availability and uptake. Further, plants are also not a completely passive player. Cereals have the ability to release metal chelating non-proteinaceous amino acids – phytosiderophores- that can alter the solubility, availability and uptake of metals. Release of phytosiderophore causally determines the Fe deficiency response of wheat. Another study on S and Fe interaction revealed that the transcript expression of S transporter (SULTR1;1) requires not only low level of S but also a sufficient level of Fe while the reverse was true for Fe transporter YS1 expression. We also showed that a limitation at the level of release of the PS was responsible for low Fe use efficiency of the Fe

deficiency susceptible wheat cultivars and that multi micronutrient deficiency caused a greater induction of PS synthesis in comparison to iron deficiency but not in the PS release suggesting, that the PS release is determined by a threshold. Importance of micronutrient remobilization under nutrient deficiency induced senescence has been evidenced and its manipulation may facilitate grain biofortification. Investigations into the role of natural chelators showed a stronger induction of DMAS gene, involved in the biosynthesis of deoxymugineic acid, under Fe deficiency. Further, root response, nutrient sensing and signalling mechanism, phytohormone regulation under organic farming may get altered to influence nutrient use efficiency and thus, requires a greater insight to decipher the contribution of various soil and plant attributes towards mineral nutrition of crop plants under organic agriculture. ■

Invited Talk –III

Organic farming for improved onion quality and sustainable soil health

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Organic farming in India and developed countries is gaining importance for its quality produce, environmental safety and profitable livelihood especially for production of fruits and vegetables. Area under organic farming in India is increasing at a faster rate and the cultivated area under certified organic farming has grown almost 17 fold in last one decade. It involves ecologically sound practices and promotes use of organic amendments, crop residues, enhancement of soil fertility through biological processes, biological methods of pest and disease management practices, cultural and mechanical methods of weed control while excluding synthetic agrochemicals.

Consumer demand for safer and healthier food along with environmental protection has increased over last decade. Onion being used as fresh, preference for organic onion is more over conventionally produced onion. The research is focused on organic farming to increase the crop productivity, improve quality of the produce and to protect the environment from pollution. The experimental evidences showed that the yield gap between organic and conventional farming is larger than 20% due to challenges in the maintenance of nutrient availability in organic systems. The results of the experiment conducted at ICAR-Directorate of onion and Garlic Research, Pune showed that the organic farming produced 24.6-43.6% lesser onion yield over conventional farming. However, organic farming increased TSS, total phenol, total flavonoid and ascorbic acid content significantly over conventional farming in onion. A number of studies conducted to examine nutritional value of organic farming reported higher values of various phenolic compounds in organic farming compared to conventional farming. In onion, among the organic amendments, vermicompost application showed higher total phenol (21.5%), individual phenolic

compounds, flavonoids (79.3%) and ascorbic acid content (22.5%) over conventional farming.

Organic farming has increased soil organic carbon, improved microbial activity and dehydrogenase activity significantly over conventional farming. It also sustained initial soil fertility status and soil health over the years of cultivation. However, the conventional agriculture negatively affected soil organic matter, microbial activity and soil fertility.

Although the organic farming produces lower yield as compared to conventional farming, it improves the quality of produce and sustain soil health. In addition to that, the organic produces are safe and free from pesticide residues. The reduced yield could be compensated with premium price available in the market for organically produced produce over conventionally produced produce. Further, research needs to be strengthened to increase the crop yield under organic farming by synchronising nutrient availability with crop demand, suitable pest and disease management and weed management during critical growth period. ■

Paper Presentation – I

Settling and Ovipositional Preference of Whitebacked Planthopper, *Sogatella furcifera (Horvath)* on selected Rice Genotypes

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Rice planthoppers such as the brown planthopper (BPH), Nilaparvata lugens (Stal) and the whitebacked planthopper (WBPH), Sogatella furcifera (Horvath) are considered as 'green revolution' induced pests. The present investigations were made to study the settling and Ovipositional preference of S.furcifera on resistant and susceptible genotypes. The pre-germinated seeds were sown individually 20 cm row and 5 cm apart in three replications. Twenty days after seeding, approximately 1500-2000 second instar nymphs were released in the centre and covered with a fiberglass mesh cage. The number of nymphs settled on each genotype was counted at 2, 6, 24, 48 and 72 hours after infestation (HAI). At six hours after release, significantly higher percentage of nymphs oriented on TN_1 than on other genotypes. However, after 24 hour, the percentage of nymphs settled was the lowest in IR 72 (6.22) and was on par with CB 08 504 (7.15), CB 06 535 (7.40), PTB 33 (7.60) and PTB 41 (7.97) compared to TN1 (17.47). At 48 and 72 hour after release, significantly higher percentage of nymphs settled on TN1 compared to other resistant genotypes. The lowest percentage of nymphs was settled in CO 43 (5.02) which was on par with IR 72 (5.51) and PTB 33 (4.60) at 48 HAI. Similar trend was observed in 72 HAI. Ptb 41 had the lowest number of nymphal emergence of 13.50 number/plant while PTB 41 recorded the highest percentage of unhatched eggs (85.50 per cent) and the lowest number total eggs laid 13-08 504 and IR 64 (91.17 number/plant). ■

Paper Presentation – II

CO_2 fixation and carbon sequestration in upland rice (Ahu rice), monsoon rice (Sali rice) and summer rice (Boro rice) ecosystem

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Agricultural soils are considered a significant stock of C within global C budget; changes in the soil C stock have certain implications on the mitigation of climate change. On the other hand the terrestrial ecosystem also serves as the source and sink of atmospheric C. The present investigation was undertaken to work out the atmospheric C fixation ability of an ecosystem and contribution of ecosystem to soil C storage, more precisely to address the phenomenon of C sequestration in an agroecosystem. We focused on the soil carbon storage potential of different rice ecosystem along with carbon fixation ability of the ecosystems. Rice ecosystems studied were upland (Ahu), monsoon (Sali) and summer rice (Boro) ecosystem. Experiments were conducted in the North Bank Plain Agroclimatic Zone (NBPAZ) of Assam, India in the Tezpur University campus. Results of the experiments conducted in three rice ecosystems upland (Ahu), monsoon (Sali) and summer rice (Boro) revealed that ecosystems has different potential to sequester and store soil organic carbon. Within an ecosystem carbon storage varied significantly in the field planted with different rice cultivars. Soil CO_2 efflux did not vary within the ecosystems and this CO_2 efflux was influenced by soil moisture content, soil temperature, photosynthesis, root activity and availability of substrate. CO_2 efflux varied in the field with different cultivars. Photosynthetic rate and biomass accumulation revealed a good correlation with soil organic carbon and soil carbon storage irrespective of the ecosystem. Crop productivity was highly influenced by the soil carbon. In Ahu rice ecosystem soil planted with cultivar Kapili had higher carbon storage potential over cultivar Luit. In Sali rice ecosystem cultivar Ranjit and in Boro rice ecosystem cultivar Kanaklata had higher carbon storage potential over other high yielding and indigenous varieties and can be considered as suitable for large scale cultivation in the field, for efficient C sequestration.

Key words: Soil carbon sequestration, rice ecosystems, CO2 efflux , photosysthesis ■

Paper Presentation – III

Intercropping of vegetable crops under *Ailanthus excelsa* based agro forestry system.

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A field experiment was conducted to develop a suitable Ailanthus excelsa based agro forestry system for higher productivity in Western zone of Tamil Nadu. Tomato, brinjal, bhendi, cluster beans and vegetable cowpea were intercropped in 3 years old Ailanthus excelsa. Results revealed that the growth and yield of intercrops were reduced under intercropping compared to pure cropping. Among the test crops, tomato was most affected and cluster bean was the least affected. However the benefit cost ratio was highest for brinjal (3.02:1) and lowest for vegetable cowpea (2.35:1) due to the higher productivity in brinjal. Growth of Ailanthus was also influenced due to intercropping with cluster beans and vegetable cowpea. The tree height and DBH of Ailanthus was highest when intercropped with cluster beans (15.21% and 10.00 % increase over pure tree) and the lowest was observed with tomato (4.30 % and 2.50 % increase over tree alone).

Key words: Ailanthus, intercrops, growth attributes, yield.

■

ABSTRACT

Paper Presentation – IV

Organic production exotic vegetables for kitchen garden

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Organic farming practices that preserve soil fertility and maintain or increase organic matter content that reduce the negative effects of drought while increasing productivity. Vegetable quality will be improved through organic cultivation and completely reduces the hazardous due to exorbitant use of pesticide and fungicides, The food we are now consuming contains high residues due to much of pesticides and herbicides. In earlier the usage of chemicals was very much reduced and maintaining the correct quantity of nutrient content in vegetables . But, now the chemical usage is enormous so this situation has to be changed. Exotic vegetables are rich in nutrients and contains high amount of anti –oxidants . Nutritional wise lettuce ,palak and broccoli are considered to be the most perfect vegetables. American cancer society deems broccoli is an anti-cancerous food ,it contains "sulphoraphane" which is known to have anti-cancer properties The vegetables growing popularity of international cuisine in India and are being popular among households. Hence the study was undertaken with the objectives of to increase the yield and quality of lettuce, broccoli and palak and to compare the nutritional quality of vegetables using organic and conventional media at dept of vegetable crops, HC&RI, TNAU, Coimbatore during 2015. The organic media consisted of vermicompost,coir pith enriched with azospirillum, phosphobacteria, humicacid, seaweed,azophosmet and azadirachtin whereas the conventional media contains red earth,sand and FYM and with recommended dose of inorganic fertilizer. The research trial included the materials of lettuce cv iceberg, lolarosa and red leaf., in spinach cv local variety and in broccoli cv Fiesta. The results revealed that the high chlorophyll content was recorded in organic culture of ice berg (0.4366/100g), lola rosa (0.186mg/100g),redleaf (0.6154mg/100g) and spinach 0.35133mg/100g) , high ascorbice acid content was recorded in ice berg (2.4mg/ 100g), lola rosa (2.633mg/

100g),red leaf (0.2.566 mg/100g) and spinach (14.2664mg/100g) , high calcium content was obsvered in ice berg (17.8mg/100g), lola rosa (0.186mg/100g),red leaf (17.1mg/100g) and spinach (14.06mg/100g) ,Iron content was recorded in ice berg (0.4066mg/100g), lola rosa (0.38mg/100g),red leaf (0.413mg/100g) and spinach (2.516mg/100g) and high fibre content was recorded in ice berg (2.05mg/100g), lola rosa (1.90mg/100g),red leaf (2.05mg/100g) and spinach (2.205mg/100g) in organic cultivation of vegetables whereas the yield contributing parameters on number of leaves and weight of leaves were maximum in conventional media but the total number of marketable leaves were maximum in organic media than the conventional media and nutrient content is high in organic means and the media also retained the fertility status was maximum in organic media than conventional media ■

Paper Presentation – V

Impact Assessment of Biopriming Interventions for Nutrient Use Efficiency-Indian story

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Since environmental stress negatively affects crop growth and productivity throughout the world and the energy crisis threatens the *sustainability* of both irrigated and rainfed system, it is becoming increasingly evident that priming techniques can enhance and improve the performance of crops without deteriorating the natural resource base.Among the available options , on-farm seed priming is a simple, proven technology that has been an age old practice, tested, and refined in laboratories, in experimental plots, and by farmers themselves in their fields. It's easy to use with a wide range of crops in many different farming conditions. Farmers in the indo-gangetic plains of Utta Pradesh, India prime rice ,wheat, maize and pulse seed before sowing. This simple method is now spreading to other parts of the country as well . Although priming with water or tiny amounts of phosphorus, boron and zinc is common but use of microbes can make a huge difference. Biopriming is becoming a potentially prominent technique to induce profound changes in plant characteristics and to encourage desired attributes in plants growth associated with fungi and bacteria coatings. Biological factors such as fungi and bacteria are used in biopriming which includes: fungi and antagonist bacteria and the most important of all are Trichoderma, Pesodomonas,Glomus,Bacillus, Agrobacterium andGliocladium. Therefore, seed priming in combination with low dosage of biocontrol agents has been used to improve the plant performance, stabilize the efficacy of biological agentsin the present set up of agriculture and reducing dependency on chemical inputs. ■

Paper Presentation – VI

Iron nutrition of rice in the era of sustainable agriculture

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Rice is staple food of more than half the world population. But nutrients such as protein and minerals are meagerly present in rice grain. It is well known that more than 30 % of world population is affected by Fe deficiency anemia. So biofortification of rice with Fe will be a practical solution to combat anemia which is prevailing in developing countries. Cadmium contamination of rice is another serious health concern during rice cultivation. Repeated application of Cd contaminated phosphate fertilizer had resulted in massive Cd contamination of rice fields across the globe. So approaches are being carried out to enhance nutrient content as well as to reduce the toxic metal content in rice. We have challenged the problem of Fe fortification in rice with Fe nanoparticles synthesized in our laboratory. It has been found that treatment of nanoparticles enhances Fe content in rice plants during pot culture and the treatment also helped to uphold photosystem efficiency in rice plants. Nanoparticle treatment also had resulted in progressive changes in linear electron transport rate and non-photochemical quenching - a process which dissipates excess light energy during photosynthesis. Our studies with Cd minimization in rice using green manure and Fe salts revealed that these soil amendments reduce Cd accumulation in rice plants. It is also revealed that Fe supplement enhances photosynthesis performance under Cd stress. But it is noteworthy that vermicompost prepared from green manure lead Cd accumulation in rice. Thus the present study discusses the significance of Fe nutrition and organic farming in Fe fortification as well as Cd minimization in rice. ■

Paper Presentation – VII

Bioprospecting for plant growth promoting Bacillus from semi-arid tropics,

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The selected Bacillus isolates, obtained from the semi-arid tropics of North Gujarat (India), efficiently solubilized insoluble phosphate. The isolate BCRh10 solubilized 37.84 and 96.76 ìg ml^{-1} of phosphate at an incubation of 2 and 10 days. Numerical analysis of phenotypic character revealed a high degree of polymorphism and grouped these strains into two at similarity coefficient of 0.71 whereas the strain BCRh10 stood as an outlier and was positive for most of the carbon sources. The functional efficiency of these isolates as PGPR (plant growth promoting rhizobacteria) was further tested by ability to produce enzymes (ACC deaminase, protease, cellulase, pectinase, and chitinase) necessary for catalyzing reactions for nutrient mobilization; and which in addition to certain metabolite (siderophore and HCN production) promote inhibition of fungal plant pathogens. The isolates varied widely for these attributes and showed presence of more than one type of biochemical activities. The isolate BCRh10 produced highest quantity of IAA (94.82 µg/mL), was positive for most of the enzymes and metabolites, and adjudged most efficient in suppressing the fungus Alternaria burnsii and Fusarium solani. The evolutionary history based on 16SrRNA gene sequence was inferred using the UPGMA method and evolutionary distances were computed using Maximum Composite Likelihood method using MEGA5. Grouping of the isolates in the factorial coordinate analysis was in congruence with that of the phenotypic characterization based on carbon utilization pattern and the 16S rRNA gene sequence. ■

Paper Presentation – VIII

Influence of Phosphorus and Potash Solubilizing Bacteria on Growth, Yield and Quality of Turmeric (*Curcuma longa L.*) under North Eastern Himalayan Region

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North Eastern Himalayan Region of India is bestowed with all prerequisite for successful cultivation of turmeric. The demand for organic turmeric (Curcuma longa L.) is increasing among the health conscious consumers due to its anti-cancerous and other bioactive properties. However, the soil of North Eastern region is deficient in phosphorus. Potassium also play an important role in rhizome development of turmeric and continuous cultivation of turmeric on same piece of land leads to depletion of potassium level in the soil. With this background, turmeric var. Megha Turmeric-1 was grown with four organic manures viz. compost (20 t/ha), vermicompost (5 t/ha), poultry manure (6 t/ha) and mustard cake (3 t/ha) and two biofertilizers (Pseudomonas fluorescens and Frateuria aurentia) under the foothill condition of Manipur at an altitude of 800 m above msl. Biofertilizers were applied sole or in combination with each organic manure through rhizome treatment (10 g/kg of seed rhizome) and soil application (10 kg each/ha after 30 days of planting). No chemical fertilizers and pesticides were applied to the plants except control plots. Plants grown under bio-organic inputs exhibited maximum values in most of the growth and yield parameters as compared to inorganic management. The maximum projected yield per hectare (27.58 t/ha) was recorded with Vermicompost + Pseudomonas + Frateuria, as compared to 24.71 t/ha under inorganic management. In terms of quality, maximum curcumin content (6.50%) and oleoresin content (8.10%) were recorded with Compost + Pseudomonas + Frateuria and Vermicompost + Pseudomonas + Frateuria, respectively. Maximum build-up of soil nutrients (NPK) was associated with Vermicompost + Pseudomonas + Frateuria. Hence, growing turmeric with organic manure along with phosphorus and potash solubilizing bacteria may be recommended for maximizing the yield and quality of organic turmeric as well as to restore the soil fertility under North Eastern Himalayan Region.

Paper Presentation – IX

Effect of integrated Plant nutrient system on soil biological health in ared loam soil

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The balanced fertilization of major elements could be beneficial for the growth of plant above ground parts and roots. Farmers need to change their fertilization strategy that reflects their economic pressure and the nutrient supplementation remains a threat because of the escalating prices and their ill effect .Hence the concept of Integrated Plant Nutrient System (IPNS) is gaining popularity as an ideal system of nutrient management. IPNS approach aims to enhance soil and crop productivity through a balanced use of mineral fertilizers combined with organic and biological resources. Hence a study was carried out during 2011-12 to assess the conjugal effect of manures and chemical fertilizers on the dynamics of major agriculturally significant soil enzymes, available nutrient status yield and yield attributes of Okra .Thirteen treatments involving different inoculants like Azosprillium,PGPR mix-1,Phosphbacterins and amendments like neem cake were used .Results of the experiment revealed that application of NPK (505) ,PGPR mix -1 enriched vermicompost+ N,P&K was found to be the best treatment both in sustaining soil biological fertility and economic returns. Available micro nutrients (Fe, Cu, B),biological properties of soil viz. Dehydrogenase,Cellulase and protease activities and biometric characters of bhindiie. Plant height ,and no of fruits.The most substantial index of biological activity in the soil is its enzyme activity and therefore it can give an idea of biochemical processes in the soil.Enzyme activity number was highest for the same treatment with the application of NPK 50% as PGPR mix -1 enriched vermicompost in combination with inorganics .On farm Trials (OFT) and Multi location Trials (MLT) is to be carried out at farmers field for confirming the results. ■

Paper Presentation – X

Fermented Foods: A microbial Approach for amelioration of Health Related issues

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Preface: Health of an individual is a function of disease incidence, nutrition and hygiene, genetic and environmental factors. Disease incidence and nutrition related problems can be easily tackled by following some healthy food practices. Incidence of diseases pertaining to deficiency of Calcium and Iron, Osteoporosis and further lifestyle related diseases like diabetes, hypercholesterolaemia, cancer can be ameliorated by adopting a few food processing methods. Fermentation is one of the processes involving microbial intervention to improve the nutritional value and quality of food. Apart from nutritional improvement, there are many other benefits associated with consumption of fermented foods. If the fermented food product is not heat processed, it can act as a vehicle to transport organisms involved in processing (may be probiotic organisms). Probiotic microorganisms not only antagonize with the pathogens in GI tract, they do involve in metabolic pathways of human system and thereby help in reducing cancer incidence, diabetes and cardiac problems. With increasing incidences of diabetes, cardiac problems and many such ailments can be minimized with a strategy that includes simple method of including fermented foods in our daily diets so as to achieve good health. ■

Paper Presentation – XI

Regulatory mechanisms of hesperidin in male STZ induced diabetic and myocardial infarction (MI) rats;

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Diabetes mellitus (DM) is a chronic metabolic disorder characterized by high levels of glucose in the blood due to the non-secretion of insulin or insulin insensitivity (ADA, 2005). Diabetes affects 180 million people worldwide. It is estimated that around 300 million people may be affected by 2025 with Diabetes Mellitus. Cardiovascular diseases accounts for 80% of death among diabetic patients. Suffering from diabetes is one of the risk factor for cardiovascular disease, it leads to diabetic cardiomyopathy (DCM). The object of the study was to examine the 7groups; each group contains 6 rats duration of 30 days, Groups I-normal, II-diabetic (50mg/kg BW of STZ, single dose), III-diabetic + hesperidin (100mg/kg BW/day), IV-diabetic + Glibenclamide, V-ISO(11mg/kg BW/29th,30thday), VI-diabetic+ISO, VII-diabetic + ISO + hesperidin. Oral treatment of hesperidin showed significantly reduced blood glucose, total cholesterol, Triglycerides, HDL, LDL and VLDL concentrations and increased body weight were observed when compared with experimental groups ($p<0.05$). In conclusion, hesperidin treatment showed significant influence on the decreasing levels of total lipid profile accompanied by the hypoglycemic, hypolipidemic activity of MI in diabetic treated rats.

Keywords: Hesperidin, diabetic cardiomayopathy, hypercholestemic, hyperglycemic, hypolipidemic.

Paper Presentation – XII

Exploitation of potentials of organic fruit production in North East India

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North East Region (NER) of India comprises eight states namely Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura. Total geographical area of NER is 2.55 lakh km^2, which is about 8% of India's total area. Physiography of NER is divided into three divisions —Meghalaya plateau, northeastern hills and Brahmaputra valley. NE hills alone accounts for 65% of the total land area, Brahmaputra valley 22% and Meghalaya Plateau covers 13%. Average annual rainfall in the region is 2500mm. Less than 18 % of net cropped area is under irrigation. NER enjoys suitable agro climatic condition for growing wide array of horticultural crops. With exception to mandarins and to a certain extent to banana and pineapple, majority of fruit crops in the region are largely grown in homestead gardens. The region has tremendous potential for growing all the subtropical, tropical and temperate fruit crops organically. The Zone-wise, nutrient-wise consumption pattern of fertilizers clearly depicts that in South Zone a total of 153.19 kg, in West Zone a total of 84.64 kg, in North Zone a total of 192.32 kg, in East Zone a total of 161.08 kg while in North East Zone a total of only 51.73 kg NPK per hectare fertilizers are Consumed. The major share of whatever little fertilizers consumed in the North East Zone largely goes to the plantation crops like tea, rubber as well as to the cereal crops grown in the region. The low fertilizer consumption pattern in the region clearly depicts farmers' tendency of non using inorganic fertilizers for fruit production. This situation compelled the fruit production organically by default in the region. However, it would be a challenging task for the fruit growers of the region to produce fascinating fruit crops of the region organically not merely by default but primarily as well as substantially by practice of organic farming. State like Sikkim of the region from the beginning of the current year is already one step ahead in proclaiming to be the first state in the country to be organic. In addition, another

NER state Tripura is already in limelight by proclaiming positions as Organic Pineapple Producer among the sixty Agri Export Zones of the country. Mizoram, Meghalaya and Assam states have taken initiative to produce mandarins, lemons, passion fruits and pineapples organically. Manipur Organic Mission Agency is planning organic production of mandarins, lemons and pineapples as a first step in six hill districts of the state. Arunachal Pradesh has formed state Soil Health Mission as an initial step for entry into systematic organic fruit production. With the existing diversified tropical, subtropical and temperate fruit crops in NER, exploitation of potentials of organic fruit production in the region would definitely be a giant step in making the entire NER as the Organic Hub for fruits in the country.

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Paper Presentation – XIII

Evaluation of certain fern plants extracts against diamondback moth, *Plutella xylostella l.* in cabbage

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Cabbage is important cruciferous vegetable grown in India with an area of 4,33,870 hectare. Diamond back moth is notorious pests of cabbage. Management of this pest has become a remarkable task and farmers apply chemical pesticides once in a week for the effective management of this pest. However indiscriminate use of chemicals has resulted in problems like resurgence, resistance, replacement, impact on non-target organisms, including humans, environmental pollution. Increasing awareness about the deleterious effects of insecticides. Now farmers and researchers are switching over to botanical pesticides, which overcome many problems associated with chemical insecticides especially in the vegetables. In nature more than 1800 plant species are reported to have biopesticidal properties. Our present study mainly focus on use of certain fern plant extracts against P. xylostella under laboratory condition. Three ferns (Diplazium esculentum, Christella parasitica and Blechnum orientale) extract has been tested on the larva of p. xylostella in the lab condition. All of these extracts showed statistically significant control over the untreated control plot. The larval mortality was low at low concentration of these plant extracts after 24 hours of treatment but showed increase in larval mortality with the increase in the concentrations being maximum at 20% concentration. The maximum larval mortality was 36.66% after 24 hours of treatment in case of D.

esculentum which increased to 73.33% after 72 hours of treatment indicating D. esculentum to be the most toxic to larvae of P. xylostella. In comparison to this, the larval mortality was 0.66% after 24 hours and 13.33% after 72 hours of treatment in untreated control. The efficacy of D. esculentum was altered the feeding behavior of P. xylostella, reduced the larval and pupal weight, prolonged the pupation period, malformed the pupa and adult were recorded under in vitro.

Key words: Brassica oleracea , Plutella xylostella, Fern plant extracts.

Keynote V

A brief history of organic agriculture and rural community in South Korea

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Organic agriculture used to be prevalent in South Korea until the 1960s by necessity as in Cuba since the early 1990s. The first fertiliser plant was built in 1961 in South Korea. Ever since, the government agricultural policy has focused on an increase in food production to the self-sufficient level. The growth-oriented agricultural policy has promoted the practices of conventional agriculture characterised by mechanisation, specialization, and the heavy use of agrochemicals. Whena reasonably high level of economic affluence in rural areas was obtained, the traditional labour-sharing network started fading. Various organic agriculture movements have emerged in South Korea since the 1990s. The agrotourism industry based on organic agriculture has blossomed and community-supported organic agriculture has flourished over the last one decade. Although only 1.0% of the total agricultural land in South Korea was under organic management as of 2014, the organic agriculture movements have been at the heart of rural social and environmental movements in rebuilding traditional rurality in South Korea.

Key words: Agricultural industrialisation, Saemaul (New Village) Movement, rural return migration, agrotourism, organic agriculture.

■

Keynote VI

Bats and plant pests: current knowledge and perspectives

Xavier Puig Montserrat
Spain

There are approximately 1200 species of bats worldwide, of which around 70% (all belonging to the suborder Microchiptera) eat insects above all else. Insectivorous bats can gather in vast numbers and this enables them to exert great pressure on the insect populations they prey on. Although the effect of bats on insect community dynamics is still poorly known, evidence suggests that they play an important role in the regulation of insect populations. A single gathering of around 1 million Brazilian free-tailed bats, amedium-sized American species, is estimated to consume every season between 500 and 1,000 tons of insects. The diet of many bat species has been studied by researchers in recent decades and the list of insects consumed by bats is known to encompass virtually every family of nocturnal insects, including many pest species. The 'arms race' between bats and insects, which has led to the development of a number of evolutionary adaptations in insects enabling them to elude bats, provides evidence of the influence bats have and have had on the life history of insects. Hearing, for instance, is best developed in nocturnal moths susceptible to being predated by bats and these moths have an optimal hearing range tuned to the frequencies predominantly used by bats (20–60 KHz). Like other insects, moths have also developed specific reactions to elude their attackers that are triggered when an ultrasound is heard. In the past decade there have been attempts to quantify the impact bats have on insect populations and, in particular, to evaluate the pest control service that bats provide. The first research on the subject, published in 2006,contains calculations that the annual economic contribution made by bats to the $5.5-million Texan cotton industry is around $750,000, corresponding to the annual cost of the pesticides that would have to be applied to maintain yield levels if bats were absent. Furthermore, the cost of losing bats at a continental scale (considering just North America)has been estimated to be at least $3.7 billion per year (with a maximum of $53 billion/year). Similar estimations for a staple crop such as rice have been made in Thailand by linking data on populations of a common medium-sized species (wrinkle-lipped bat) and its estimated consumption of certain major

rice pests present in the region. In this particular context, bats were estimated to prevent the loss of 2,900 tons of rice per year, thereby providing an annual ecosystem service valued at $1.2 million. Since a part of the rice production in the region is for self-consumption, this monetary value can be translated into food security and equates to the annual rice meals for more than 26,000 people. All the aforementioned valuations use extant populations of bats and their estimated pest consumption to assess the impact of the ecosystem services they provide as pest controllers. They all stress the importance of implementing appropriate policies aimed at preserving functionally important bat populations including endangered populations, as well as those that live in human-modified environments. A promising step forward has been taken in rice paddies in northern Iberia, where rice is cultivated in highly modified landscapes, devoid of trees and any other natural structure that could provide shelter for bat populations. Three years after deploying a number of bat boxes around rice paddies, a population of soprano pipistrelles (the smallest European bat) became established and a dramatic drop in the populations of the striped rice borer, a rice major pest, was detected. These bats' consumption of this pest disrupts its population cycles and reduces its density to below economic injury level. Bats thus have acted here as an integrated ecological pest control method. Another promising field for both research and applied pest control is how to extend habitat improvements to other regions and crops to enable or enhance bats' ecosystem services. This presents a number of challenges that will have to be overcome. Public perception of bats needs to be greatly improved if they are to be efficiently protected. Explaining how bats control pest populations is not easy and may not be feasible in some cases since little is known about the response of bat populations to habitat improvements. Finally, it must be born in mind that enhancing certain bat populations may give rise to unexpected conservation issues that negatively affect other species or ecosystems. Thus, as in any other biological control system, research and implementation will have to go hand-in-hand if undesired side effects are to be avoided and optimum results obtained. ■

Keynote VII

SEEDS OF HOPE
Sustainable Organic Agriculture Systems along with Fair Trade in India, Africa and Europe & Proposals for Joint Research Projects between ECOLAND and IUCOFSA about "Biodiversity of Autochthone Pepper Varieties in India" and "Vrikshayurveda Indigenous Organic Knowledge Center"

Rudolf Bühler
President ECOLAND INTERNATIONAL, Germany

SEEDS OF HOPE

Seeds of Hope is a international project scheme for sustainable and organic agriculture with indigenous and smale scale farmers in India, Africa and Eastern Europe. The seeds are organic grown spices which are exported upon Fair Trade principles to Germany to avail the rural producers and societies a sustainable and valuable income out of their natural resources which creates hope for a better life.

The project aims in sustainable rural development based on a eye to eye partnership with Ecoland International along with exchange of knowledge, introduction of organic cultivation and processing practices and finally the sourcing of the organic spices upon guarantied prices and its export to Germany. Prices offered to the small scale and indigenous farmes are 40 – 100 % on top of conventional market prices and the increased value is empowering the rural communities and enables them for improved living conditions in terms of housing, food, health care and education.

The first project has started 2001 within in the Tiger Sancturary at Thekkady, Kerala,

India, focusing on the Vanchivayal tribal community. Later a close partnership with Wayanad Social Service Society in the north of Kerala was introduced and led also to a substantial financial support for establishing a large spice processing unit. Main crops are pepper, cardamom, nutmeg, allspice, curcuma and ginger.

In Serbia SEEDS Of HOPE started in 2005 by introducing firstly ever organic farming practices and establishing a farmers cooperative for the cultivation of organic chillies, poppy seed, soya, black mustard and sunflowers.

In Zanzibar, Africa, SEEDS Of HOPE started in 2012 also by introducing organic agriculture practices and creating a producers cooperative with the local small scale farmers. There we grow mainly cloves, cinnamom, lemon grass, vanilla and also nutmeg.

Further projects are on the way in Java, Tanzania and Namibia. The core values of all SEEDS Of HOPE projects and activities are

- regional partnerships between north and south on eye to eye level
- sustainable development for rural societies living in remote areas
- exchange of values and goods upon fair trade principles
- fair share to the farmers and producers out of the value chain
- implementing solidaric business principles
- introduction and promotion of organic agricultural practices by knowledge transfer, education and extension work
- preservation of autochtone breeds and plants
- strengthening the peasants rights by developing a International Charta of Peasants Rights in cooperation with the UN

The SEEDS OF HOPE projects are substituted with 50 % of their project expenditures by German Government funds released through Deutsche Entwicklungs Gesellschaft, DEG.

Proposal for a Joint Research Project between ECOLAND and IUCOFSA: Saving the Biodiversity of Autochthone Pepper Varieties in India - The Arc of Pepper.

The Malabar Coast of South India is the original place of pepper (Piper nigrum) from where it spread to other countries and continents. So far, within this region of rich plant diversity, different varieties of the pepper plant

have been identified. This includes wild species as well as more than 100 cultivated varieties domesticated and developed by the local indigenous growers and rural people over centuries.

The abundant natural treasure of more than 100 autochthone varieties has to be considered as the common value of the local rural people. Along with the domesticated varieties, there is still a huge natural treasure of wild pepper species observed. As with the last generation of farmers, pepper was still cultivated upon the foundation of a wide range of pepper varieties, what we call agro-biodiversity. This meant that, each and every pepper variety was selected based on its specific value in terms of taste, content of piperine, oleoresin and essential oil, yield, medicinal value and its resistance to pests and diseases as well as its adaptation to various soil and micro-climatic conditions within the region. The local farming communities had their own and indigenous varieties, most of which was superior in taste, whiles others were adapted to drought or poor soil conditions depending on the area of cultivation.

During the last decades of "modern" agricultural practices, particularly with focus on the green revolution, which was spear-headed under the supervision of western industrial economies and science, the traditional and autochthone Indian varieties were steadily replaced by hybrids to a large extent which accounted for more than 90 % of pepper plants cultivated. The agro-biodiversity of pepper, grown at the Malabar Coast up to the Western Ghats, has been drastically reduced within a short span of 20-30 years only.

Research institutions, Agricultural boards and Extension Services were responsible for supervising the move to the so called "High Yielding Varieties HYV" and taught the farmers to use those hybrids along with the intensive application of chemical fertilizers and pesticides. The reality is that the HYV-Hybrids serve their expected high yields only by the intensive use of the chemical inputs. As a result of this influence and the promotion of agrochemical practices along with the "HYV-Hybrids", the traditional and autochthone varieties have gradually disappeared.

If no measures are taken to rescue them, they risk being endangered and becoming extinct within a short period of time.

Furthermore, future systems of sustainable agriculture have to be proven upon new parameters, such as resource-efficiency and energy-efficiency systems through which, we can understand the great value of the autochthone traditional varieties which were developed during centuries by the work and wisdom of the local farmers to serve humans needs. Local and indigenous varieties are well adapted to the individual local climate and soil conditions and produce sustainable yields even under critical soil and climatic conditions.

The goal is therefore to come up with a new and revised economic view upon future agricultural systems, particularly through a macroeconomic view in order to consider the external costs created by the agro-industrial and agro-chemical system and on the other hand the external benefits and values of the organic and holistic way of production by focusing on its balanced results and the benefits to society. By considering these important factors, one can understand the need and value of such a project for preserving the abundant natural treasure of the autochthone pepper varieties within the Malabar Coast stretching through to the Western Ghats.

With this in mind, it is worthwhile to not only consider the intensive and peculiar taste of indigenous pepper varieties but also the medicinal values as well as the natural resistance against several pests and diseases which are needed for sustainable organic cultivation practices. It is for this reason that Ecoland Herbs and Spices - Germany, represented by its founder Rudolf Bühler, in cooperation with Wayanad Social Service Society (WSSS), Kerala -India, represented by Father Bijo Thomas Karukappally as Director, have since August, 2016 put together a joint project to rescue and preserve all survived traditional autochthone pepper varieties along the Malabar Coast up to the Western Ghats in order to establish an "Ark of Pepper", located at the WSSS Botanical Garden in Boys Town Orphanage Complex, 12 km away from Mananthavady, Kerala- India.

Project Design:

a. Collection of the historic and traditional autochthone pepper varieties within the area of Malabar Coast up to the Western Ghats, including wild species and gathering them in plots and the site-buildings of WSSS Botanical Garden.

b. Identifying 'pepper varieties' as pure varieties upon phenotypic identification

and classification as well as with genetic screening and the registration of the identified pure varieties under its traditionally conveyed name.

c. Establishing of a herbarium accordingly, to serve as a scientific ex-situ reference library at the site-buildings of WSSS Botanical Garden.

d. Conservation of the collected autochthone varieties under in-situ and ex-situ conditions: Botanical Laboratory and Mother-Nursery at Boys Town.

e. Establishing field plots with selected pilot farmers from WSSS for the means of scientific research upon the individual values of each variety as resistance to diseases and drought, specific soil conditions, yield, medicinal value and specific content analysis.

f. At a later stage, identify specific marketing values to provide added value to producers in order to motivate them to shift from "HYV-Hybrids" to the traditional autochthone Varieties.

g. Reconstructing and extension of the plot and buildings at the Botanical Garden of WSSS including the laboratory.

Proposal for a Joint Research Project between ECOLAND and IUCOFSA : Establishment of a Indigenous Organic Agricultural Knowledge Center of Kerala/India including the acient practices of Vrikshayurveda

Along with the collection and revitalization of the endangered rare pepper varieties, the project will seek to collect all reachable books, scripts and oral contributions by tribals and local farmers about the tradition of "Vrikshayurveda", considered as the indigenous knowledge on organic and sustainable farming practices laid down in the ancient Sanskrit scripts. It is an important task to look into the wisdom of the historic scripts as well as to the orally conveyed wisdom and knowledge of the indigenous people. This will lead to a Library and an archive which would be known as the "Indigenous Organic Agricultural Knowledge Center" at the plot including a Training Hall for its dissemination and popularization.

As we have observed in Central Europe a strong movement to adopt "bio-dynamic" cultivation practices based upon protagonists as "Steiner, 1924" under the brand of "Demeter", the project will also want to observe and research into similarities and applied

preparate work and practices between both biodynamic systems, Demeter and Vrikshayurveda. Furthermore a bio-dynamic and Vrikshayurvedic preparate center will be established within the Botanical Garden plot for the future use of WSSS member farmers.

Both sides agreed that the specific part of the project which is a so called Gen-Bank will be not subjected to any trial or attempt of "Genetic Engineering" practices. The Ark of Pepper will entirely serve to rescue and revitalize the historic treasure of indigenous and autochthone pepper varieties of South India which are the common assets of the local farmers who developed them through generations and centuries. The local farmers will always have free access and use them for their organic and bio-dynamic cultivation.

The same applies to the "Indigenous Organic Agricultural Knowledge Center" with the indigenous knowledge being understood as a treasure of the rural societies and small scale farmers, but not yet protected by the UN Organization WIPO which covers and protects only the intellectual knowledge as a property, but not the indigenous knowledge, thereby posing a threat of being grabbed easily by interested groups and business followers.

So far the "Ark of Pepper" including the establishment of the "Indigenous Organic Agricultural Knowledge Center" is being financed for the next 3 years till the end of December, 2018 jointly by Ecoland Herbs and Spices and WSSS. Further commitments would be developed within time. ■

Keynote VIII

Nanoparticles for Sustainable Agriculture

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For many years, people are using various types of growth promoting substances to increase the growth rate of plants. Because of the difficulties in the modification of chemical and microbial growth promoting substances, scientists focus mainly on nanotechnology. Nanotechnology opens a large scope for novel applications in the field of biotechnology and agricultural industries, because of the unique physicochemical properties of nanoparticles like high surface area, high reactivity, tunable pore size, and particle morphology. Nanoparticles can serve as "magic bullets", containing herbicides, nano-pesticide fertilizers, or genes, which target specific cellular organelles in plant to release their content. Despite the plenty of information available on the toxicity of nanoparticles to plant system, few studies have been conducted on mechanisms, by which nanoparticles exert their effect on plant growth and development. The appropriate elucidation of physiological, biochemical and molecular mechanism of nanoparticles in plant leads to better plant growth and development. In this work, we will be trying to present on the role of nanoparticles (NPs) in plant growth and development and also on the mechanism of action of nanoparticles. The use of nanotechnology for the sustained release of fertilizers will be discussed. Finally, we will summarize the role of nanotechnology for the preservation of grains, fruits and vegetables ■

Keynote IX

Biopesticides and Practices for Protecting The Plants In Organic Farming from Insects and Diseases

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ABSTRACT

Considerable inclination towards organic farming in developed as well in developing countries has been observed in recent years after realization of the impact of pesticide-loaded food on health, environmental pollution, and land degradation caused due to high input agriculture. Organic agriculture is different from other approaches of sustainable agriculture in two ways. One crop rotation for build up of soil fertility is a must and second the use of synthetic inputs is prohibited. Therefore, pests and diseases may lead to significant losses to crop yield in the absence of good management practices. The presentation will focus on the role of biopesticides and the practices for maintaining the productivity of organic agriculture by minimizing cop loses due to pests and suggests ways to enhance it by improving the existing models. ■

Invited Talk-III

Organic Fruit Production in North-east India: Concerns, Strategies and Priorities

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Organic horticulture is one of the holistic production management system found to meet the objectives of sustainable horticulture. It is considered the most coherent and stringent system that is designed and maintained to produce horticultural products by the use of methods and substances that maintain the integrity of organic horticultural products until they reach the consumer. Organic production has the potential to sustainably produce sufficient food of a higher quality at a lower price.

North east region is characterised by difficult terrain, wide variations in altitude and slope, land tenure system and indigenous cultivation practices. Horticulture is the main economic activity in the region and despite major impact of green revolution in the irrigated areas of the country, development and modernisation of horticulture has escaped this region as was evidenced by poor adoption of modern technologies and low consumption of fertilizers. The region harbours a number of tropical, sub-tropical and temperate fruits.

The north-east region has enormous potential for organic fruit production. Favourable soil and climatic conditions have great scope for organic production of tropical, sub-tropical and temperate fruits in the region. Organic fruit production in the region has direct implications in improving the sustainable livelihood of the community.

Although North-east is considered as by default organic, no concrete steps has been taken to implement organic sector scientifically. High costs of certification, lack of experts in the field level are some of the lacunas which hinder the development of organised organic fruit production in the region. In addition, lack of marketability at a premium over conventional produce, inadequate certifying agencies, and inability of the farmers to reach the certifying agencies, marginal and

fragmented land holdings, practice of shifting cultivation and organized marketing system prevents the development of organic fruit production in the region. It is the high time to shift from organic by default to organic by process. There is need for institutional research on developing of organic horticultural food production packages in all the thrust crops of the region. ■

Invited Talk IV

Nutritional potential of organic matter and bio-fertilizers on growth, yield and productivity parameters of tomato (*Solanum lycopersicum l.*)

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A field experiment was conducted at Aligarh Muslim University Research Station during 2012-2015 to determine the nutritional potential of organic matter such as sunflower seed cake and bio-fertilizers like Azospirillum brasilense and Glomus fasciculatum individually as well as concomitantly alongwith different recommended doses of inorganic nitrogen on the growth, yield attributes and productivity parameters of tomato (Solanum lycopersicum L.). Significant improvement was observed in growth as well as yield parameters such as height of plants, fresh as well as dry weights, number of primary branches, percent pollen fertility, green fruits per plant, green fruit yield per plant, ascorbic acid content and chlorophyll content of tomato in all the treatments as compared to untreated control which seems to be due to the presence of growth promoting molecules in the organic matter and bio-fertilizers. Combined inoculation of the bio-fertilizers, A. brasilense and G. fasciculatum shown higher improvement in growth parameters. Azospirillum was found to be more effective than Glomus. Soil application of caster cake, bio-fertilizers and 100% recommended dose of nitrogenous fertilizers results the highest improvement in growth as well as agronomic parameters like plant nitrogen, phosphate and potash , and available soil nitrogen, phosphate and potash. Soil biological properties and metabolic activities of plants were found to be greatly influenced due to the presence of these nutrients and hence increased growth and yield of plants. This type of investigation is to increase productivity to develop organically based agricultural farm produce. This may be useful in long run to sustain the crop production without altering the exiting harmony in our natural bio-resources. This method of organic farming can be used as economical and eco-friendly alternative to hazardous agrochemical fertilizers.

Keywords: Castor cake, Azospirillum, Glomus, Growth parameters, Tomato

Invited Talk-V

Sustainable Animal Agriculture through Organic Farming and IPM for complementing the concept of holistic one health approach

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ABSTRACT

In the recent past growing concept of organic farming is emerging in sustainable agriculture (since 1990 the market for organic food and other products has grown rapidly, reaching $63 billion worldwide in 2012). It is complementing to the growing concept of 'one health aspect'. It is been described in the research paper that, over the centuries, farming systems that were once mutually beneficial to people, animals and the environment have transformed into intensified 'factory' systems that are destroying rural livelihoods and increasing urban migration and poverty. More recently, coinciding to this, India became the signatory to WTO and Paris agreement of 2015. It has created an urgent need for protection of our ecosystem and supply of residue free organic food; it has all together forced to inculcate the tactics of organic farming well supplemented by IPM practices. ■

Invited talk VI

Eco-friendly approaches to manage insect pests of Indian Sandalwood (*Santalum album Linn.*),in the present scenario of its cultivation

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Santalum,the genus under Santalaceaecomprises economically important species, which are xylem-tapping root hemi-parasites with high valued aromatic heartwood. Among them the Indian sandalwood, S. albumLinn., is the most appreciated in the world, for its fragrant heartwood and oil used for incenses, soaps, creams, perfumes, carvings, paintings and religious worships for over 4000 years. It is acknowledged as "Royal Tree" in subcontinent and is one of the most economically important tree species occupying a pre-eminent position in Indian forestry. The tree has been synonymous with ancient Indian cultureand is having long history through and its importance and medicinal value has been mentioned in many quotes of age-old writings.For more than 5000 years, India has been the traditional leader of sandalwood oil production but in the last decade it has decreased to meagre 300 tonnes of wood per year with an annual rate of reduction of 20% since 1995. Currently due to the amendments in the Sandalwood acts in 2001 and 2002, respectively by the Karnataka and Tamil Nadu governments, sandalwood is emerging as one of the important species for cultivation.

Progressive farmers and private entrepreneurs are cultivatingsandalwoodin agroforestry, farm forestry and in varied agri-silvi-horticultural and mixed plantation systems with other agricultural, horticultural, commercial and other tree species based on their need and choice. In these areas many pests of agricultural and horticultural importance were found affecting sandalwood.The more diversified areas recorded more insect pests and more natural enemies and the severity of the infestations were less. In less diversified areas the severity of sapsuckers and stem borers were more, often resulted in undertaking control measures. An analysis of sapsuckers and

defoliators with the natural enemies like coccinellids, mantids and spiders showed positive linear relationship with pest and predators. Studies demonstrated that natural ways of insect pest management viz., habitat diversification, organic amendments and conservation and release of bio-control agents as ideal options to manage the insect pest problemsof sandalwood under its cultivation in areas outside forests. ■

Invited talk VIII

Exploring the Plant Microbiome of medicinal plants for environment friendly agriculture practices

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Abstract

Emerging understanding on plant associated microorganisms as plant microbiome indicates the significant impact of microorganisms on plants as its second genome. This is because, the microorganisms play key role in plant growth and development and also in disease resistance. Unraveling the complexity involved in the plant- microbe interaction and decoding the chemical conversation between plant and microorganisms can provide information to enhance yield and disease resistance in plant by modulating the microbiome. The plant probiotic and antiphytopathogenic mechanisms of plant microbiome from biodiversity rich areas can have immense applications in new generation agriculture practices. Our research during last few years has generated a microbiological insight into the medicinal plants of Kerala with exciting scientific evidences for the product forming potential of microorganisms as phyto-stimulants or phyto-vaccinating agents. ■

PAPER PRESENTATIONS

Paper Presentation XIV

Bio efficacy of some commercially available eco-friendly insecticides against diamondback moth, *Plutella xylostella l.* in cabbage,

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Cabbage (Brassica oleracea L. var capitata) is one of the most important cruciferous green leaf vegetables grown extensively in tropical and temperate regions of the world. Cabbage crop is attacked by a number of insect. Of these, diamond back moth, Plutella xylostella has become serious pest from sowing to harvest. To mitigate the losses, farmers use large quantities of pesticides. Indiscriminate use of pesticides has led to many problems like insecticide resistance, resurgence and residues. Recent advances in research being directed towards development of safer and eco friendly methods such as botanicals, biopesticides which are relatively safe to natural enemies and reduces pesticide load in environment. Keeping this in view, investigations were undertaken to test the commercially available six ecofriendly pesticides against P. xylostella. The pooled mean results of these sprays is presented as follows. Among the different eco-friendly insecticides evaluated against P. xylostella, the Refresh @750 ml/ha and Signature @750 ml/ha closely performed well with the least leaf damage percentage of 6.9 and 8.4 percentage, respectively which is followed by Dichlorvos 76 SL @500 ml/ha. with 10.53 percentage leaf damage. The three insecticides (Refresh, Signature, Dichlorvos) were statistically on par. Bio Dose Magnum @ 750 ml/ha proved the least effective one among eco-friendly insecticides recording the mean leaf damage percentage of 13.59. However all the eco-friendly insecticides tested exhibited statistically better than the untreated control (34.55%

LD). The highest yield of 24.07 t/ha obtained from the Refresh treated plots followed by Signature (23.53 t/ha). The cost-benefit ratios varied from 1:5.8 to 1:24.4 in different insecticidal treatments. Dichlorvos gave the maximum monetary benefit with highest cost-benefit ratio (1:24.4) followed by Refresh with a recorded monetary cost-benefit ratio of 1:18.5, respectively.

Key words: Brassica oleracea , Plutella xylostella, Eco-friendly insecticides.

■

Paper Presentation XV

Insecticide resistance management through use of entomopathogenic fungi *Metarhizium anisopliae (metch.)* against *Nilaparvata lugens (stal)* in rice

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Rice (Oryza sativa) is the staple food of people in almost all asian countries and a major source of livelihood in their rural economics. The productivity of rice is threatened by more than 100 species of insect pests attacking the crop from nursery to harvest causing enormous yield loss. Of these, Rice Brown plant hopper Nilaparvata lugens has become serious pest of rice in almost all rice growing tracts of India, because of their ability to remove the sap content of the stem leading to considerable reduction in yield. Over the years, control of N. lugens has been almost exclusively based on application of chemical insecticides. Some of the insecticides earlier effective, for example quinalphos and phoshomidon are also now being reported to cause resurgence of N. lugens. Therfore , the need for alternative method for control of N. lugens has become vital to slash- down chemical pesticidal usage. Utilization of bioagents can help in solving ecological problems resulting from toxic pesticides and manage the pest population efficiently. By considering the benefits and potential of microbials, an experiment was conducted to evaluate the efficacy of entomopathogenic fungi Metarhizium anisopliae against N. lugens under laboratory conditions. Three Metarhizium anisopliae strains were collected from the various institutes. Among the three strains, Metarhizium (M1) strain (NBAIR) showed a higher percentage of mortality against N. lugens (76.67%) under in vitro conditions. Four concentration of each of the

strain were used along with untreated control to determine the LC_{50} and LT_{50} for the Metarhizium strains. The least LT_{50} value of 4.4 days was registered in M1 strain with the spore concentration of 1 X 10^8 and the LC_{50} value was 3.4 X 104 respectively.

Key words: Metarhizium anisopliae, Nilaparvata lugens, Rice

■

Paper Presentation – XVI

Formulation of crop specific ready to use growth media for organic vegetable production in urban farming

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Majority of urban dwellers especially those living in very small holdings or flats lack the basic requirement for farming *viz*., quality growing media for filling the container or grow bags. This necessitated the need for standardizing and developing a ready to use growing media for various commonly grown vegetables in urban farming. Crop specific ready to use growth media for organic cultivation were formulated with different combinations of organic substrates based on nutrient uptake and POP recommendations of crop with manures supplied on N equivalent basis. UV stabilized growbags of 39 cm height and 26 cm diameter capable of holding up to 9 kg of growth media were used as the containers. Modified base media for growth media formulation was prepared by substituting sand with a combination of rock sand, coir pith compost and vermicompost in equal proportion. Treatments were: N1- 100% POP as basal, N2- 150% POP as basal, N3: 200% of POP as basal: N4: 25% of N full P&K as basal + 75% N in 2 splits, N5: 50% of N full P&K as basal+ 50% N in 2 splits, N6: 75% of N full P&K as basal+ 25% N in 2 splits, and N7: modified base media alone. The growth media was enriched with manures of respective source and incubated for a week to supply the recommended dose of N, P and K respectively as per the treatments. Initial N, P, K status of modified basal media was estimated as 1.4 % N, 0.009% P_2O_5 and 0.11% K_2O. The study showed that standardization of soil based growth medium with 25 % of nutrient requirement given as basal and remaining N in s split doses recorded an yield of 171 g per bag for bhindi which was on par with T5 and T6. Ready to use soil based growth media for container grown tomato and amaranthus standardized at 75 % NPK supplied as basal dose (T6) recorded high fruit yield per bag of 292.33g and 551.83g respectively and was on par with T2,T3,& T4 and T5.

Paper Presentation – XVII

Intercropping of vegetable crops under *Ailanthus excelsa* based agro forestry system

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Abstract

A field experiment was conducted to develop a suitable *Ailanthus excelsa* based agro forestry system for higher productivity in Western zone of Tamil Nadu. Tomato, brinjal, bhendi, cluster beans and vegetable cowpea were intercropped in 3 years old *Ailanthus excelsa*. Results revealed that the growth and yield of intercrops were reduced under intercropping compared to pure cropping. Among the test crops, tomato was most affected and cluster bean was the least affected. However the benefit cost ratio was highest for brinjal (3.02:1) and lowest for vegetable cowpea (2.35:1) due to the higher productivity in brinjal. Growth of *Ailanthus* was also influenced due to intercropping with cluster beans and vegetable cowpea. The tree height and DBH of *Ailanthus* was highest when intercropped with cluster beans (15.21% and 10.00 % increase over pure tree) and the lowest was observed with tomato (4.30 % and 2.50 % increase over tree alone).

Key words: *Ailanthus*, intercrops, growth attributes, yield.

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Paper Presentation – XVIII

Entomopathogenic nematodes: a potential biocontrol agents for the management of soil-dwelling insects

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Entomopathogenic nematodes (EPN) are non-segmented roundworms, are lethal pathogens of insect pests and are found in soil throughout the world. Nearly 98 valid species of Steinernema and 25 species of Heterorhabditis have been described worldwide and still surveys for EPNs have been conducted in many parts of the world. EPNs are mutually associated with bacteria of the family Enterobacteriaceae; the bacterium carried by steinernematidae is usually a species of the genus xenorhabdus, and that carried by heterorhabditidae is a species of photorhabdus. EPNs and their associated bacteria comprise together a highly pathogenic complex that is able to invade and kill insect hosts within two days. Both bacteria and nematodes produce a variety of factors interacting with the insect immune system and helps to overcome host defences. The third juvenile stage of EPNs is referred to as the infective juvenile (IJ) or the dauer stage. IJs of both genera release their bacterial symbionts in the insect host body and develop into fourth-stage juveniles and adults. The insects die mainly due to a septicemia. They have many advantages over chemical pesticides are in operator and end-user safety, absence of withholding periods, minimising the treated area by monitoring insect populations, minimal damage to natural enemies and lack of environmental pollution. Improvements in mass-production and formulation technology of EPNs, the discovery of numerous efficient isolates and the desirability of increasing pesticide usage have resulted in a surge of scientific and commercial interest in these biological control agents.

We have studied the efficacy of EPNs against eggplant ash weevil, Myllocerussubfaciatus, suagrcane white grub, Holotrachiaconsanguinea and arecanut white grub,

Leucopholislepidophoraand L. burmeisteri. Third-instar and pre-pupal stages of M. subfaciatus were susceptible to EPN species but the pre-pupal stage was more susceptible. In a pot experiment, S. carpocapsae caused significantly greater mortality against both life stages M. subfaciatus than H. indica. Sugarcane field trail data showed that the percentage reduction in H. consanguinea grub population was significantly higher using H. indica at a dose of 2.5×10^9 IJ ha^{-1} than S. abbasi and phorate application. Phorate application was more efficient in reducing the grub population than both nematode species at the lower application rate (1.25×10^9 IJ ha^{-1}). In arecanutfield experiment, H. indica at both application rates (1.7×10^5 and 3.5×10^5 IJ $palm^{-1}$) caused higher percentage reduction of L. lepidophora larvae than S. abbasi and cholorpyrifos. Chlorpyrifos treated plots caused higher percentage reduction of the grub larvae than S. abbasi at lower rate 1.7×10^5 IJ $palm^{-1}$. However, S. abbasi at 3.5×10^5 IJ $palm^{-1}$ performed at least equally well than the chlorpyrifos treatment. The arecanut yield from the H. indica treated plots at 3.5×10^5 IJ $palm^{-1}$ was at least 85.4% higher than those from water control and 33.3% higher than that in the chlorpyrifos treatment. The cost benefit analysis showed that H. indica is promising biocontrol agent for L. lepidophoracontrol in arecanut field. We also studied the phoratic association between EPNs and earthworm, results showed that although EPNs have no deleterious effects on earthworms, their passage through Eudriluseugeniae gut affected their mobility and but not virulence. In our study all tested EPN species were able to reproduce in different developmental stages of insect hosts, but progeny production rate for heterorhabditidswas significantly higher than those of steinernematids. Our observations also revealed that efficacy of EPNs against M. subfaciatus,H. consanguinea, L. lepidophora and L. burmeisterivaries with developmental stages of insect hosts and EPN species. Therefore, for the effective management of target pests, choosing the appropriate nematode to be matched with the particular target pest is paramount importance.

Keywords – biocontrol, entomopathogenic nematodes, white grubs, reproduction, earthworm.

■

Paper Presentation – XIX

Area wide integrated pest management of fruit flies in organic fruits and vegetables production

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Integrated pest management (IPM) has remained the dominant paradigm of pest control for the last 50 years. IPM has been endorsed by essentially all the multilateral environmental agreements that have transformed the global policy framework of natural resource management, agriculture, and trade. To be the most effective, IPM programs should be applied on an area-wide basis. Area-wide integrated pest management (AW-IPM) is that where producers within geographically defined growing areas should coordinate their crop protection efforts so that pests cannot find a refuge from which to re-invade the nearby production area. Presently, AW-IPM being implemented for the insect pest causing high economic losses and reduces export opportunity of the commodity. AW-IPM programs can minimize the need for sprays and thus improve the economic and environmental sustainability of the cooperating farmers. Fruits and vegetables are mostly infested by fruit flies at the time of harvest need area wide management of the pest. As fruit flies lay eggs inside the fruits and larvae eat internal content of the fruits are difficult to manage with the organic insecticides. AW-IPM program of fruit flies should also include adjacent urban/suburban properties that contain host trees which are often a constant source of pests. Organic control tactics such as the release of sterile insects and the application of mating disruption products are most effective when applied on an area-wide basis for the organic production of fruits and vegetables. Many countries have developed the AW-IPM programme with the inclusion of sterile insect techniques for the suppression of fruit flies population for export quality organic fruits and vegetables production. Therefore, AW-IPM could be an important intervention in the organic production system for fruit flies management. ■

Paper Presentation – XX

Yield and economics of ginger influenced by different management systems

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Ginger (Zingiberofficinale Roscoe.) is grown in tropical and subtropical regions of the world for its spice and medicinal values.India ranks first and contributes about 29.0 percent of total world's ginger production followed by China (26.0%), Indonesia (14.0%) and Nigeria (10.0%). During 2014-15 the country produced 7.60 lakh tonnes of the spice from an area of 11.41 lakh ha. Indian ginger has high esteem in the global market because of its characteristic lemon like flavour. Since spices like ginger form part of many of ethnic medicines, the demand for organically produced ginger is also increasing considerably in the importing countries. In this context, an experiment was conducted at ICAR-IISR, Indian Institute of Spices Research, Kozhikode during 2007-12 to compare the effect of organic, chemical and integrated management systems on yield, nutrient uptake and economics of ginger.

The treatments were 100% organic (30 t FYM + 2 t neem cake + 1 t ash + 4 t vermicompost per ha,bio fertilizer - Azospirillum and Pseudomonassp. as seed treatment and spray with Bordeaux mixture and neem oil for disease and pest control, respectively), 100 % inorganic (recommended dose of fertilizer NPK@75,50,50 kg / ha with recommended chemical methods of pest and disease control as per POP) and integrated management (20t FYM+ half the recommended N, full P and K + phosphorus solubilising bacteria and spray with Dithane M-45 and Quinalphos for disease and pest control, respectively). Improved ginger varieties released from ICAR-IISR, viz, Mahima, Rajatha and Varadha were used for the study. The treatments were

given in split plot design with 7 replications each. Soil samples were collected during 120 days after planting, yield data during harvest of the crop every year. The soil samples collected were subjected to chemical analysis as per standard procedures. Yield and economics were recorded and 5 years data subjected to pooled statistical analysis.

The integrated management system recorded maximum yield during initial years whereas maximum yield was recorded under organic during 2010 to 2012. With a premium price (25% higher than market price) B: C ratio was higher organic system compared to integrated and inorganic systems. The soil nutrient status indicated that the organic carbon and nitrogen of soils were higher under integrated and organic systems. The soil phosphorus status, calcium, zinc was significantly higher under organic system. Soil potassium status was consistently and significantly higher under integrated system.Soil enzyme activities (acid phosphatase and dehydrogenase) were higher under organic management system. Organic system of management yielded on par to that of integrated management system indicating its sustainability. ■

Paper Presentation –XXI

SEED INVIGORATION WITH ORGANIC PREPARATIONS FOR ACCELERATED GERMINATION AND VIGOUR IN BHINDI (*Abelmoschusesculentus (L.) Moench*)

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A study entitled 'Seed invigoration with organic preparations for accelerated germination and vigour in Bhindi*(Abelmoschusesculentus (L.) Moench)*' was conducted in KrishiVigyanKendra,Kollam Kerala Agricultural University, Sadanandapuram, Kollam , Kerala , during April 2016 to May 16 to study the effect of seed invigoration using organic preparations on germination and seedling characters in Bhindi, The experiment was laid out in Completely Randomized Design with 5 treatments and 3 replications. The seed treatments comprised of T_1-control (water), T_2-goat urine,T_3-Fish jaggery extract,T_4- Egg lemon jaggery extract,T_5-Panchagavyam. The seeds were treated in the respective organic preparations for 2 hours and then dried. The seeds were sown in portrays filled with a medium containing coir pith, vermiculite and perlite in the ratio 3:1:1.The study indicated that seed invigoration with these organic preparations enhanced the germination and seedling characters. Maximum germination was observed in seeds treated with fish jaggery extract (T_3) followed by seed soaking in panchagavya (T_5) and egg lemon jaggery extract (T_4) compared to the control. Significantly higher shoot and root length were recorded in seeds treated with fish jaggery extract (15.03 and 16.74cm respectively)., followed by seeds treated with panchagavya (14.42 cm and16.06cm). Seeds soaked in fish jaggery extracts gave the highest values of vigour index (3157.70) and seedling length (31.78cm) followed by panchagavya treatment. It can be concluded that seed quality could be improved by seed invigoration with organic preparations like fish jaggery extract and panchagavya. ■

Paper Presentation – XXII

Genetic assessment for yield and quality components UNDER ORGANIC AND CONVENTIONAL FERTILIZER MANAGEMENTS IN GROUNDNUT (*Arachis hypogaea L.*),

M.Manjubhargavi, M.Shanthi Priya, D.Mohan Reddy and B.Ravindra Reddy

The present investigation was conducted at dryland farm of S.V. Agricultural college, Tirupati, during *kharif* 2014 to study the variability and genetic parameters, character association and path analysis in fourty four genotypes of groundnut under organic and conventional fertilizer management separately.

Analysis of variance carried out in respect of twelve quantitative characters revealed highly significant differences among the genotypes for all the characters under both the managements except shelling percentage, which showed non- significant difference under organic fertilizer management and significance at 5 % under conventional fertilizer management, indicating the presence of considerable amounts of genetic variation for different traits in the present material. Based on mean performance the genotypes TCGS-1330, TCGS-1343, TCGS-1349, TCGS-1381, TPT-1, Narayani, TCGS-1328, ICGV 06420, ICGV 03042, TCGS-1073, Bheema, TCGS-1157-A, TCGS-1333 and TCGS-1157 were found to be good for yield as well as for quality traits under organic and conventional fertilizer managements.

The estimates of PCV and GCV were high for the characters such as pod yield per plant and kernel yield per plant under both the managements; for number of pods per plant under organic fertilizer management and for hundred seed weight under conventional fertilizer management indicating the presence of genetic variability for these traits and less influence of environment. Thus, direct selection for these traits would result in further improvement of pod yield under respective environment.

High heritability coupled with high genetic advance as per cent of mean was recorded for the character plant height under both managements and 100 seed weight under

conventional fertilizer management indicating the presence of additive gene action and selection may be effective for improvement of these traits. Moderate heritability coupled with high genetic advance as per cent of mean was recorded for the characters primary branches per plant, number of pods per plant, pod yield per plant and kernel yield per plant under both the fertilizer managements and the characters mature pods per plant, harvest index and 100 seed weight under organic fertilizer management. Improvement can be brought about in these traits through simple pedigree method of breeding and phenotypic selection would be effective.

The association analysis in both the managements indicated significant positive association of pod yield per plant, mature pods per plant, number of pods per plant, shelling percentage, primary branches per plant, days to 50 % flowering, harvest index, 100 seed weight and protein content with kernel yield per plant under both the managements, indicating the possibility for simultaneous selection of these characters towards the improvement of kernel yield. Oil content displayed a significant negative association with kernel yield per plant under both organic and conventional fertilizer managements. Hence judicious selection programme might be formulated by repeated intermating to break the negative correlation between oil content and kernel yield per plant for simultaneous improvement of these characters under organic and conventional fertilizer management.

Path analysis revealed high positive direct effects of pod yield per plant and shelling percentage under both organic and conventional fertilizer managements and significant positive correlation of other traits with kernel yield was due to positive indirect effect *via* these traits. Hence selection would be more effective through these traits to improve kernel yield under both the environments.

Conducting variety trials under organic farming conditions may help to select the best varieties available in the pool of existing varieties to be propagated organically. Although the organic sector profits from the breeding efforts of the conventional breeding sector, variety trials under organic farming conditions show that the modern varieties are not in all the cases the best for organic

agriculture. Conventional breeding efforts in the past have largely developed in response to the demands of intensive agricultural production (*i.e*, increased yields through dependence on external inputs of synthetic fertilizers and pesticides). Alternatively, organic farming supportive of a philosophy promoting the self regulating principles of the soil, the plants and the animals, requires a distinct breeding programme. Organic farmers need varieties that adapt well to specific soil and fertility conditions. The different requirements for varietal characteristics clearly highlight the importance of breeding and selecting varieties suitable for organic farming under organic conditions. The organic systems approach requires varieties that match a different crop ideotype in which it is more important to adapt the variety to the organic environment rather than the environment to the variety. ■

Paper Presentation –XXIII

Identification of tropical crop plants suitable for cultivation in Nedumbana Panchayat, Kollam district, Kerala based on the flowering plant flora of the Pazhangalam Muhurthy sacred grove

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The aim of the present study was to identify the crop plants for the cultivation inNedumbana Panchayat, Kollam district, Kerala by analyzing the flowering plant flora of a sacred grove. About 39 plant species from the sacred grove were identified and the fourth version of the APG system was chosen for depicting the systematic position. More than 90 tropical crop plant species, which could yield vegetables, spices, condiments, fruits, nuts, yams and aroids, were identified. The farmers of the Nedumbana Panchayat, where the PazhangalamMuhurthy sacred grove is situated, were found to cultivate bananas, yams, aroids, vegetables, ginger, coconut, pepper, areacanut, rubber, cassava, turmeric, and rice. The survey conducted among the most experienced farmers identified during the course of study also provided valuable information about the various types of plant diseases, which inflict their crops and cause economic loss. The present study also included the mapping of the sacred grove by QGIS software and determination of the physico-chemical properties of the soil samples collected from different sites within and outside the sacred grove. On completion of the present study, it was become obvious that it may provide information about tropical plant species well suited for cultivation in Kollam district. Thus, this work will be a novel effort, and a very important source of information to the scientific community.

Key words: APG system, spices, condiments, QGIS software, Nedumbana Panchayat

Paper Presentation XXIV

Management of Sigatoka leaf spot disease of banana through an integrated approach

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Bannas are one of the main agricultural crops in the world, and the main fruit crop. Sigatoka leaf spot is considered as the most serious fungal disease causing economic loss of crop in almost all banana growing areas including India, cause significant reduction in affected leaf area resulting in yield losses of 50 per cent or more and promotes premature fruit ripening. A field evaluation was conducted in a farmer's plot at Kottarakkara in Kollam district in Kerala to evolve an efficient management strategy for the disease. Disease Severity Index (DSI), yield characters viz., bunch weight, number of hands per bunch and numbers of fingers per bunch, were recorded at the time of harvest of the plants in each treatment. At vegetative stage carbendazim gave maximum disease suppression of 40.93 % over control. After the second and third series of treatment application at monthly interval, maximum disease suppression was observed in plants treated with propineb (50.32 %), tebuconazole (49.84 %), difenoconazole (48.16 %) and the combined application of the biocontrol agent & organic compounds (47.79 %). Highest yield (19.17 t/ha) and maximum yield increase over control (34.56) were recorded in asoxystrobin followed by diluted cow's urine (18.92 t/ha, 32.81). ■

Paper Presentation – XXV

In vitro sensitivity of *Azospirillum lipoferum* and Azotobacter chroococccum to new rice herbicide – bispyribac sodium + metamifop

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Weeds are the prime biological constraint in direct seeded rice. Herbicidal management of weeds is the only viable option available for the farmers at present. Azospirillum lipoferum and Azotobacter chroococcum are the two commonly used N bio fertilizers in rice. These two N fixing organisms play a major role in sustainable agriculture by reducing the use of chemical fertilizers through N fixation and avoiding the toxic effects of chemicals by degrading them to non- toxic products. Hence, testing the compatibility of herbicides to N fixing organisms is of great importance in sustainable agriculture. The sensitivity of Azospirillum lipoferum and Azotobacter chroococcumto new premix herbicide mixture, bispyribac sodium+ metamifop were studied in vitro by Disc Diffusion Method. The experiments were conducted in completely randomized block design with seven different concentrations of bispyribac sodium + metamifopviz., 100, 120, 140, 160, 180, 200 and 220 µL L^{-1} corresponding to 50 g ha^{-1} (below the tested field dose), four tested field doses (60, 70, 80 and 90 g ha^{-1}) and two above the tested field doses (100 and 110 g ha^{-1}) and a control (0 µL L^{1}). The experiments were repeated for confirmation. Results on the in vitro effects of herbicide mixture on the growth of Azospirillum lipoferum and Azotobacter chroococcum revealed that, the tested concentrations of bispyribac sodium + metamifop did not have any inhibitory effect. The growth was positive and very similar to that in control. The present findings revealed that soil application of Azospirillum lipoferum and Azotobacter chroococcum could be exploited along with bispyribac sodium + metamifop at tested concentrations to enhance their population in the soil, as these bacteria are important for sustaining the productivity of soil.

Keywords Bispyribac sodium + metamifop, In vitro sensitivity, Azospirillum lipoferum and Azotobacter chroococcum

Paper Presentation – XXVI

Molecular Phylogenetic Analysis of Chrysomelid Pests of *Cucurbitaceae* vegetables from North Kerala, Using Mitochondrial CoGene Marker

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ABSTRACT

Modern knowledge of insect molecular genetics has created new methods in their systematic taxonomy and pest management strategies as the group comprises major agricultural pests. It will contribute to sustainable agricultural practices, protection of the environment and maintenance of biodiversity. Chrysomelidae (Coleoptera) are polyphagus insect pests of various crop varieties including vegetables. In this study, we have PCR amplified and sequenced the partial region of cycochrome oxidase subunit I (COI) gene of *Oocassida pudibunda* (Boheman, 1856) (GenBank Accession: KX603663) of Chrysomelidae family, a morphologically diverse insect taxon. The COI gene partial nucleotide sequence obtained in the study can be used for accurate species identification as their DNA barcode.

Keywords: *Oocassida pudibunda*, DNA barcoding, phylogenetic status, COI gene.

Paper Presentation – XXVII

Productivity of rainfed rice (*Oryza sativa L.*) through agronomic practices under on Farm Adaptive Research

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The field experiment under On Farm Adaptive Research was conducted during the Kharif season 2013 at Satna District of Madhya Pradesh to assess Productivity of rainfed rice (Oryza sativa L.) through agronomic practices. RBD with 3 treatments and 9 replications of different treatments of transplanted rice were T_1 (20 cm x 20 cm + Matka khad), T_2 (20 cm x 20 cm + neem and tobacco extract) and T_3 (20 cm x 15 cm + inorganic fertilizers, conventional practice). Results show that significant and highest growth and yield attributing parameters viz., plant height (101.21 cm), Number of tillers hill^{-1} (17.89 hill^{-1}), plant dry weight 51.02 (g), no.of grains panicle^{-1} (136.67), grain yield (7.78 t ha^{-1}) and straw yield (17.06 t ha^{-1}) were recorded under treament T_2 and T_1 consisting organic component. Further, grain yield higher by 16.29% and 3.58% of treatment T_2 and T_1 respectively was higher in value than T_3. Also T_2 was 12% and 32.65% higher in value than T_1 and T_3 in straw yield. Plant dry weight T_1 was found to be statistically at par with T_2. Number of tillers panicle^{-1} of treatment T_2 (17.06) was found to be statistically at par with T_1 (17.89) OFAR result has evinced the stakeholder, including the farmers that the treatment consisting organic component possess properties to better soil health and productivity and also lessens infestation of pest, ultimately resulting enhanced productivity of rainfed rice through a balanced agronomic approach.

Keyword: OFAR, Rainfed rice, Agronomic practices and Poductivity

Paper Presentation – XXVIII

Intercropping of vegetable crops under *Ailanthus excelsa* based agro forestry system

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A field experiment was conducted to develop a suitable *Ailanthus excelsa* based agro forestry system for higher productivity in Western zone of Tamil Nadu. Tomato, brinjal, bhendi, cluster beans and vegetable cowpea were intercropped in 3 years old *Ailanthus excelsa*. Results revealed that the growth and yield of intercrops were reduced under intercropping compared to pure cropping. Among the test crops, tomato was most affected and cluster bean was the least affected. However the benefit cost ratio was highest for brinjal (3.02:1) and lowest for vegetable cowpea (2.35:1) due to the higher productivity in brinjal. Growth of *Ailanthus* was also influenced due to intercropping with cluster beans and vegetable cowpea. The tree height and DBH of *Ailanthus* was highest when intercropped with cluster beans (15.21% and 10.00 % increase over pure tree) and the lowest was observed with tomato (4.30 % and 2.50 % increase over tree alone).

Key words: *Ailanthus*, intercrops, growth attributes, yield.

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Invited Talk IX

Organic Leaf production under Ultra High Density planting in moringa (*Moringa oleifera Lam.*) cv. PKM-1"

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An experiment was conducted to study the "Standardization of Ultra high density planting system for organic leaf production in Moringa and nutrient encapsulation through Nano – technological approach to fortify the milk" at Tamil Nadu Agricultural University during 2015-2016. The experiment was laid out in split plot design with five main plot treatments (spacing) *viz.*, M_1 - 10 x 15 cm (6.66 lakh plants/ha), M_2 - 15 x 15 cm (4.44 lakh plants/ha), M_3 -20 x 10 cm (5 lakh plants/ha), M_4 - 20 x 20 cm (2.5 lakh plants/ha), M_5 - 40 x 20 cm (1.25 lakh plants/ha) and five subplot treatments (organics) S_1 - FYM 25 t/ha, S_2 - Vermicompost 12.5 t/ha, S_3 - Sheep manure 25 t/ha, S_4 -Humic acid 20 kg/ha, S_5 - Control with three replications. First harvest of leaves was commenced at 60 days after sowing, subsequent leaf harvest was done at 45 days interval. After harvest, subplot treatments (Organics) as per the schedule were applied on the concerned main plots. Among the different plant density, plant density of 40 x 20 cm (1.25 lakh plants/ha) resulted in increased plant height, number of leaflets per plant, number of branches per plant, fresh leaf yield per plant and leaf yield per plot. Among the different organics, humic acid @ 20 t/ha registered the increased plant height, number of leaflets per plant, number of branches per plant, fresh leaf yield per plant and leaf yield per plot. The treatment combination of 40 x 20 cm with humic acid 20 kg/ha recorded the increased plant height, number of leaflets per plant, number of branches per plant, fresh leaf yield per plant and fresh leaf yield per plot under high density planting system.

Key words: Drumstick, Ultra High Density Planting system, Yield traits.

Paper Presentation – XXIX

Wisdom of the Earth: Ecosophy and Holistic Agriculture

K M George (Kondothara)
Chairperson Dr Paulos Mar Gregorios Chair, Mahatma Gandhi University

Paper Presentation – XXX

Dying folklore and mechanic reproduction of organic life style

Rajesh Komath
Mahatma Gandhi University, Kottayam

The Kothamuriyattam (a fertility cult) performed in Malayalam month of Kanni (September-October) had a connotationof faith and sustenance of human society. But this form of fertility cult are almost dead. In the 1970s almost all homes had cattle and cattle based farming practices. Kothamuri is performed for the protection of the cattle and to bless them with improved yields. When homes with cattle reduced, cattle used in fields also came down, thus Kothamuriyattamceased to exist. It remind the fact that any form of folk ritual which has a social function to perform will survive only when society want its use as a function to perform in their everyday life. When those roles of cult become untimely, the significance of the social function of the folk rituals faded away. ■

Paper Presentation – XXXI

Probiotics for organic aquafarming

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Aquaculture or aqua farming is the farming of aquatic organisms intervention in the rearing process to enhance production and it is the fastest growing food production sector in the world. Aquaculture supplies fish and other aquatic products rich in protein, vitamins, minerals and essential fatty acids which play an important role in global efforts for the elimination of hunger and malnutrition. Intensified aquaculture results in disease outbreaks and common measure of treatment is by the use of chemotherapeutics and antibiotics. But its use and abuse creates problems like emergence of antibiotic resistant bacteria, biomagnification of antibiotics, on consuming antibiotic treated fish the residue transfers to humans and creates health problem, the remaining deposited in the water and soil also resuts in environmental pollution. Globally the ban on antibiotics or its restricted use is encouraged and the demand for organic products is increased, the same trend reflects in aquaculture also. Research on organic nutrition and organic aqua feeds for the better utilization of dietary nutrients, for the improvement of fish gut health, for optimized growth, performance and disease resistance is needed. Microbial interventions or by use of bacteria based biopreparations like probiotics as biologic drugs plays a vital role in both land and water based agriculture. Probiotics are harmless bacteria that help the well being of the host animal and contribute, directly or indirectly to protect the host animal against harmful bacterial pathogens. Probiotics in fishes stimulate appetite and produce vitamins, detoxify harmful compounds in diet, and breakdown of indigestible components. In addition to these benefits the application of probiotic in aquaculture improves the water quality and thereby reduce the environmental pollution. Application of probiotics to the aquaculture is either by incorporating with fish feed or directly as water additives or through vaccination. In aquaculture both gram positive and negative bacteria, bacteriophages, unicellular algae and yeast are categorised under probiotic. To increase the acceptance it is better to use species specific (isolate and applied in the same host) probiotic. Safety is an important requirement for probiotics, generally the probiotics comes under GRAS category (Generally Regarded As Safe). ■

Paper Presentation – XXXII

NON-CHEMICAL WEED MANAGEMENT ON ORGANIC BRINJAL (CO 2) [*Solanum melongena, (L.)*]

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Field experiment was conducted at organic certified field, Annur, Coimbatore district, Tamil Nadu, during kharif 2015 to identify suitable non chemical weed management practices for manage of complex weed flora in organic brinjal. The experiment was laid out in randomized block design with three replications. The treatments comprised of different non chemical weed management practices viz., Live mulching with sunnhemp after 30 days of growth (T_1); PE application of Corn Flour @ 1 t/ha (T_2); PE application of Corn Flour @ 1 t/ha fb HW at 60 DAT (T_3); Live mulching with Multi Varietal Crops (Navathaniyam) after 30 days of growth (T_4); PE application of Sunflower dried stalk solution on w/v basis @ 1:10 lit/ha (T_5); PE application of Sunflower dried stalk solution on w/v basis @ 1:10 lit/ha fb HW at 60 DAT (T_6); Mechanical weeding twice using twin wheel hoe weeder on 30 and 60 DAT (T_7); Hand Weeding on 30 and 60 DAT (T_8); Weed free check (T_9); and Unweeded control (T_{10}). Observations were recorded on weed characters like weed flora, weed density, dry weight and plant growth parameters viz., plant height, plant dry matter production, leaf area index and yield parameters like number of fruits/plant, fruit length, fruit girth and individual fruit weight. In the experimental field, Cyperus rotundus under sedge Euphorbia geniculata and Trianthema portulacastrum under broad leaved weeds were the predominant weeds. The experimental results revealed that considerable reduction in the density of weeds, weed dry weight and higher weed control efficiency and plant parameters like plant height (102.42 cm), dry matter production (3905 kg/ha), leaf area index (3.95), crop growth rate (5.92 g/m^2/day) and yield attributes like fruit length (7.57 cm), fruit girth (18.10

cm), number of fruits/plant (20.7/plant), individual fruit weight (57.5 g) and was recorded higher in PE application of Corn Flour @ 1 t/ha fb HW at 60 DAT (T_3) at 90 DAT.From the results, it can be concluded that, PE application of Corn Flour @ 1 t/ha fb HW at 60 DAT (T_3) reduced the weed density and weed dry weight conspicuously below the economic threshold level and increased the yield, net return and benefit cost ratio in organic brinjal.

Key words: Organic brinjal, Corn flour, Sunflower dried stalk solution, weed control

Poster Presentations I

Nutritive requirements for the vegetative growth of Shiitake mushroom (Lentinulaedodes (Berk.) Pegler) and its yield impacts on various agrowastes

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Mushrooms are one of the most promising sources of functional food, drug, dietary supplements, healthy beverages etc. Lentinula edodes or Shiitake is a white rot wood decay fungus which produces brown basidiocarps with exotic flavor. A study was conducted to determine different nutritive requirements viz. carbon and nitrogen sources for the vegetative growth of Lentinulaedodes in both solid and liquid media. Out of six different carbon sources viz.sucrose, lactose, galactose, fructose, dextrose and mannitol tested, fastest growth was obtained with dextrose as carbon source in solid media. In the broth, mannitol supported maximum mycelial dry weight of Lentinula edodes.Peptone when used as nitrogen source gave best result in solidmedia. Maximum mycelial dry weight was obtained in liquid media when ammonium nitrate was used as nutrient source.The impact of substrates on Shiitake yield by the effective bioconversion of locally available lignocellulosic agricultural wastes was also evaluated under Kerala conditions. Among the various substrates ,the teakwood sawdust supplemented with 20% wheat bran gave good yield. Teakwood sawdust gave an yield of 325.8gm/ 500 gm of dry substrate. The days for pinhead emergence was also less as compared to other substrates. Large size and enhanced number of fruiting bodies were obtained from teakwood substrate. Paddy straw substrate gave lowest number of fruiting bodies and took longest time for primodial initiation.The present study thus explored the possibilities for cultivation of Lentinula edodes using largely available agroindustrial wastes in Kerala.

Poster Presentations II

Effect of integrated Plant nutrient system on soil biological health in a red loam soil

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The balanced fertilization of major elements could be beneficial for the growth of plant above ground parts and roots. Farmers need to change their fertilization strategy that reflects their economic pressure and the nutrient supplementation remains a threat because of the escalating prices and their ill effect .Hence the concept of Integrated Plant Nutrient System (IPNS) is gaining popularity as an ideal system of nutrient management. IPNS approach aims to enhance soil and crop productivity through a balanced use of mineral fertilizers combined with organic and biological resources. Hence a study was carried out during 2011-12 to assess the conjugal effect of manures and chemical fertilizers on the dynamics of major agriculturally significant soil enzymes, available nutrient status yield and yield attributes of Okra .Thirteen treatments involving different inoculants like Azosprillium, PGPR mix-1,Phosphbacterins and amendments like neem cake were used .Results of the experiment revealed that application of NPK (505) ,PGPR mix -1 enriched vermicompost + N,P&K was found to be the best treatment both in sustaining soil biological fertility and economic returns. Available micro nutrients (Fe, Cu, B),biological properties of soil viz. Dehydrogenase, Cellulase and protease activities and biometric characters of bhindi ie. Plant height ,and no of fruits. The most substantial index of biological activity in the soil is its enzyme activity and therefore it can give an idea of biochemical processes in the soil.Enzyme activity number was highest for the same treatment with the application of NPK 50% as PGPR mix -1 enriched vermicompost in combination with inorganics .On farm Trials (OFT) and Multi location Trials (MLT) is to be carried out at farmers field for confirming the results. ■

Poster Presentations III

Shelf life of liquid organic formulation

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A study on influence of ageing on quality of liquid organic formulation was carried out in the Department of Agronomy, College of Horticulture, Kerala Agricultural University, Thrissurduring 2015 - 2016. The objective was to find out the shelf life of*Panchagavyam* by analyzing the chemical and biological properties. The experiment consisted of 11 treatments where *Panchagavyam* was stored for 1, 2, 4, 6, 8, 10, 12, 16, 20 and 24 weeks and replicated thrice in CRD. *Panchagavyam* wasanalyzed for various parameters like colour, odour, presence of mould growth and maggots, pH, EC, organic carbon, macro and micro nutrients, total microbial population of fungi, bacteria, actinomycetes and *Escherichia coli*. For preparing *Panchagavyam,*cow dung (2.5 kg), ghee (500 g), cow urine (1.5 L),cow milk (1 L), curd (1 L), jaggery (500 g), coconut water (2 L), well ripened banana (8 no.) and water (10 L)were used. The fresh preparation of *Panchagavyam* was light green with fruity smell and became darker green at the end of storage and foul odour was observed from 8th week onwards. The surface mould growth was observed in one week old *Panchagavyam*whereas maggots were appeared from16 weeks onwards.An increasing trend in the pH and EC of *Panchagavyam* was noticed during the period of storage.There was no significant variation in organic carbon content (2.65 – 2.94%) during storage.20 weeks old *Panchagavyam* recorded the highest nitrogen content (0.21%). Phosphorus content decreased while potassium content slightly increased during the period of storage.Calcium, magnesium and sulphur content was slightly improved due to ageing. The micronutrients viz. iron, manganese and zinc were also detected in *Panchagavyam*. The total microbial population was significantly influenced by the storage period. The highest fungal population (66.00×10^4cfuml^{-1}) was noticed in 20 weeks old *Panchagavyam*while the highest value forbacteria (385.00×10^6cfu ml^{-1}) and actinomycetes (250.33×10^5cfu ml^{-1})was in 12 weeks old *Panchagavyam*.It was free from *Escherichia coli*throughout the period of storage.The present investigation revealed the possibility of storing *panchagavyam* up to 6 months without quality deterioration.

Poster Presentations IV

Promises of endophytic Paraconiothyrium as a biocontrol agent

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Plants are always subjected to various kinds of diseases among which fungal diseases are very significant, as it severely affect plant growth and yield. With the changes in climatic conditions, the challenge to plant growth is of great concern. Even though various chemicals are used for the management of plant diseases, its use is getting rejection from the general public due to toxicity and health related issues. Hence natural methods to manage plant diseases are gaining more attention. Here comes the relevance of exploiting antiphytopathogenic mechanisms present in microorganisms to exploit their field applicability. In our study we have identified an endophytic fungus from rhizomes of ginger with broad antiphytopathogenic properties. The organism was identified as *Paraconiothyrium* sp. and the chemical basis of its antifungal activity was identified as chrysazin or danthron. The study is remarkably novel as it is the first report on *Paraconiothyrium* as endophyte from ginger and is the first report on chrysazin production from *Paraconiothyrium* sp. The results of the study are of immense agricultural application because of the broad applicability of the isolate to manage various diseases in plants. ■

Poster Presentations V

Biocontrol and plant growth promoting traits shown by Serratia sp. ZoB 14 isolated from Zingiber officinale

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Ginger (*Zingiber officinale* Rosc) is a tropical plant which is cultivated in tropical and subtropical coutries for its medicinal and culinary uses. One of the major problems that limit the yield of ginger is pythium soft rot or rhizome rot disease caused by *Pythium myriotylum*. Recent studies on plant- microbe interaction shows the possibility of occurrence of endophytic organisms with plant protective and growth promoting traits. The present study focused on the isolation of endophytic bacteria with antifungal activity from ginger. The selected isolate in this study designated as ZoBR14, was identified as *Serratia* sp. by biochemical and molecular based 16S rDNA sequencing and subsequent BLAST analysis. PCR screening of ZoB14 for genetic basis for antifungal property showed 100% similiarity with aminopyrrolnitrin. The protective effect of the endophytic bacterium on ginger was carried out by the bacterization of rhizome of ginger with ZoBR14 followed by *P.myriotylum* treatment. The plant growth promoting traits such as phosphate solubilization, ACC deaminase, zinc solubilization and indole-3-acetic acid production were studied. The studies confirmed that the isolate ZoB14 was having inhibitory effect on *Pythium myriotylum* along with potential for plant growth promotion as evidenced by its effect on *Vigna unguiculata* seedlings. Hence the endophytic bacteria ZoB14 can be exploited as a biocontrol and plant growth promoting agent. ■

Poster Presentations VI

Application of Endophytic Burkholderia vietnamiensis from Zingiber officinale Rosc. in Organic farming

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Endophytic bacteria can generally contribute to the health, growth and development of the plants directly by contributing in nutrient uptake and producing plant growth regulators / phytohormones. In the present study ninety six endophytic bacteria were isolated from surface sterilized rhizome of ginger (*Zingiber officinale*). All the isolates were screened for plant growth promoting properties such as phosphate solubilization, 1-Amino Cyclopropane-1-Carboxylate (ACC) deaminase activity, nitrogen fixation, ammonia production and IAA production. All of them were also screened for invitro inhibition of *Pythium myriotylum* which showed eight isolates to have remarkable antifungal activity among which *Burkholderia vietnamiensis* ZoB74 showed highest antifungal activity. Thirty five endophytes with both plant growth promoting and antifungal activity were identified by 16S rDNA method. This has resulted in the identification of the genera *Bacillus*, *Enterobacter, Serratia, Burkholderia, Alcaligenes* and *Pantoea* as major endophytic bacteria. Invitro production of Indole 3 acetic acid (IAA) by selected endophytic bacteria was confirmed by HPLC which was comparable with the standard.IAA producing isolates were also used to analyse the invivo efficiency of selected endophytic bacteria in the growth enhancement of *Vigna unguiculata*.. Invivo plant growth studies in *Vigna unguiculata* by selected endophytic bacteria revealed that the growth of all the treated plants were enhanced when compared to control. *Burkholderia vietnamiensis* ZoB74 showed highest root elongation in *Vigna unguiculata.* The study also assessed the ability of shortlisted endophytic bacteria to colonize and improve the growth of *Capsicum frutescens* in field application. which

showed that all the tested parameters increased than in the control. Flowering and Fruiting of *Capsicum frutescens* treated with *Burkholderia vietnamiensis* ZoB74 showed early flowering and fruiting when compared to the control. Hence the study revealed invivo plant growth enhancement in two model plant systems indicate the remarkable role of organisms in chemobiology of rhizome and its broad plant probiotic potential to be explored in agriculture. ■

Poster Presentations VII

Pathogenicity of Indigenous Isolates of Metarhiziumanisopliae Metschnikoff (Sorokin) to Bhindi Leaf Roller Syleptaderogata Fabricius

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Entomopathogenic fungi are important regulators of insect populations and are valued as the most versatile group of microbes for pest management in view of their wide host range and safety to non targets. Globally, there is a revival of interest in entomopathogenic fungi and research focused on these msicrobes unveiled the potential of the fungi in the genera *Beauveria*, *Metarhizium* and *Lecanicillium*as important bioagents. *Metarhiziumanisopliae* (Metschnikoff) Sorokin (Dueteromycetes: Hyphomycetes) is a well knownbiocontrol agent that infects wide range of insect orders but, the existence of many different species and even many isolates within genus *Metarhizium*that vary in virulence to various insect pests. Bhindi leaf roller *Syleptaderogata*Fabricius is a polyphagous pest that attacks *A. esculentus* and other malvaceous plants, *Amaranthus*spp and Soyabean. The pathogenicity of the four indigenous isolates and one isolate from National Bureau of Agricultural Insect Resources (NBAIR) were evaluated against Bhindi leaf roller, *Syleptaderogata*Fabricius at different concentrations. The four indigenous isolates of *M. anisopliae* were trapped using larvae of *Galleria melonella*L. Studies on the virulence of the isolates at three different concentration *viz*., 10^7, 10^8 and 10^9 spores mL^{-1} showedthe*M. anisopliae* (SP11) recorded mortality of 83.33 to 100 per cent at 168 HAT. Dose dependent mortality was recorded in all the isolates evaluated. The present study reveals the selection of the appropriate isolate of entomopathogenic fungi and its application at the required concentration is highly essential for effective management of crop pests. ■

Poster Presentations VIII

An Economic and environmental benefits of biopesticides in paddy farms: A study in Alappuzha District of Kerala State

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The increased public concerns about the potential adverse environmental effects and health effects associated with the use of synthetic plant protection necessitated the use of 'Biopesticides' in Kerala. Hence, a research study was carried out in Kerala with the specific objectives, to assess the economic and environmental impact of biopesticide use on paddy farms of Kerala in terms of its productivity, cost and returns and also to assess the environmental benefits of biopesticides with special reference to *Pseudomonas fluorescens* and *Trichogramma sps*. Alappuzha district of Kerala was purposively selected for the study as it is a Rice bowl of Kerala. To assess the economic and environmental impact of bio pesticide on paddy farms, the data collection were made from 60 no's of adopters and non adopters each from the selected four sample villages of the Chambakkulam and Veliyanadu blocks in the study district. Thus the total sample size was 120. Partial budgeting technique and Environmental Impact Quotient (EIQ) analysis was used to estimate the cost and returns, net gain and environmental benefits in bio pesticide adopter's farms in Kerala. The comparative economics in both adopters and non adopter's paddy farms showed that, the adopters and non adopters spent the amount of Rs.40790 and Rs.44389 per hectare respectively. It implies that, bio pesticide use lowering the cost in adopter's farms towards input use. On returns side, the adopters received (6191 kg/ha) an additional yield at 321 kg per hectare than non adopters farms (5870kg/ha) thus the adopters were realized, the net gain of Rs.10729 per hectare than

non adopter's farms. The positive net gain indicated the financial viability of biopesticide use in Paddy farms. The average field use EIQ value was 12.01 and 5.15 for farmers under non-adopter and adopter category. The lower EIQ value of the adopter farmers compared to that of non-adopters indicated the environmental benefits of pest management through biopesticide. The high EIQ values of the non-adopter farmers indicated the negative environmental impact of indiscriminate pesticide use. Thus, the results of the study confirmed that, there were difference in the yield of paddy with higher returns and lowering the pesticide use in bio pesticide adopter farms than the non-adopter farms.


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