Book of Abstracts

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(AGRICO 2018)

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Committee of the AGRICO - 2018

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Tel: +94(0) 11 3132827

info@tiikm.com

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MESSAGE FROM THE CONFERENCE CO-CHAIR AGRICO 2018

I am greatly honored to welcome each of you to the 5th International Conference on Agriculture (AGRICO 2018) under the theme: "Innovations in Agriculture for a Sustainable Future" during the 16th – 17th August, 2018 in Colombo city, Sri Lanka. This event is a real fruitful mutual work between the International Institute of Knowledge Management in Sri Lanka and respective partners including the partnership of Al- Balqa` Applied University in Jordan.

Both institutions were precisely designed the conference with a vision of mandating synergies; the synergy of theory and application, the synergy of research and practice, and the synergy of academia and community services. In this regard, I would like to extend Al-Balqa Applied University President, Professor Abdullah Al-Zu`bi greetings to all of you for your support in realizing this conference. He also hopes that this success case will be replicated and yearly seen.

This conference is a massive international gathering to create a solid platform to identify key challenges and solutions in the field of agriculture while strengthening the innovation systems in food and agriculture in a sustainable way. Moreover, our meetings and discussions aim at exploring the relationships between innovation, productivity and sustainability within respective roles for the government and the private sector in strengthening agricultural innovation systems and facilitating adoption at the farm and agro-food firm level. The diversity of experiences and specializations will enable us to achieve our targeted mandate and vision. It covers 12 relevant themes in fields of agriculture and innovation systems endeavor. More than 100 Authors and attendees, from six continents including unique Key Note speakers, will show us their recent developments in their fields of farming.

I would like to extend my deep appreciation to the organization and scientific committees. Thanks and acknowledgement are due to the logistics and secretary for their support and continuous follow up, that makes it a success case.

Last but not the least, I would like to assure that our role will not end at this stage, we are totally committed to follow up all the details during the days of the conference, including our social event and field trip. The International Institute of Knowledge Management (TIIKM) in

Sri Lanka and Al- Balqa` Applied University in Jordan believe that the success of this gathering is a meaningful joint work; looking towards more fruitful future cooperator for the benefit of our regions and the globe as well.

My personal respect goes out to all of you.

Thank You.

Conference Co-Chair,
Dr. Samih Abubaker,
Al-Balqa` Applied University,
Jordan.

MESSAGE FROM THE CONFERENCE CO-CHAIR AGRICO 2018

It gives me immense pleasure to send this message as the Conference Co-Chair to mark the event of the 5th International Conference on Agriculture 2018 (AGRICO 2018), organized by the International Institute of Knowledge Management(TIIKM), Sri Lanka. As the Dean, Faculty of Agriculture & Plantation, Wayamba University of Sri Lanka, I am extremely pleased to be the hosting partner of the conference.

There is no doubt that this research conference provides a platform for academics, scientists, researchers and scholars to discuss debate and exchange views on their research findings. The theme of the conference for this year has been set as "Innovations in Agriculture for a Sustainable Future". I believe that research, inventions and commercialization of research findings are extremely important for the development of a country. Hence, outcome of this conference will be of value to all stakeholders in the agricultural sector of this country.

I congratulate the members of the organizing committee for their great commitment and dedication to make this event a success. Finally, I convey my best wishes to all the presenters and participants for a successful research conference.

Conference Co-Chair,
Prof. D.C. Abeysinghe,
Dean, Faculty of Agriculture and Plantation Management,
Wayamba University of Sri Lanka,
Sri Lanka.

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KEYNOTE SPEECH

THE FUTURE OF FOOD AND AGRICULTURE: TRENDS & CHALLENGES

Udith K. Jayasinghe-Mudalige

Department of Agribusiness Management, Wayamba University of Sri Lanka, Sri Lanka

ABSTRACT

A number of "trends" are shaping the future of food and agriculture globally and the resulting "challenges" from which faced by different economies, individually and collectively, are diverse in terms the outputs, outcomes and impacts. Those trends and challenges can broadly be classified into the types of technological, socio-economic, cultural, political and environmental etc., and will be associated with, according to the Food and Agriculture Organization (FAO), Population growth, urbanization and ageing; Governance for food and nutrition security, health and poverty and inequality; Global economic growth, investment, trade and food prices, and development finance; Structural change and employment and migration; Changing food systems; Competition for natural resources; Climate change; Conflicts, crises and natural disasters; Agricultural productivity and innovation, and Transboundary pests and diseases.

It is estimated that in a world with its population is expected to grow to almost 10 billion by 2050 and under the scenario of "modest economic growth", demand for food and agriculture will be boosted by some 50 percent compared to today. The income growth in those "low to middle-income" nations will result a significant "dietary transition" towards higher consumption of meat, fruits and vegetables, relative to that of cereals. This ultimately results commensurate shifts in output and adding pressure on natural resources. Despite the fact that hunger and extreme poverty have been reduced globally over the last few decades, nearly 700 million people, most of them from rural areas, are still "extremely poor" today. As stated by the FAO, under a 'business-as-usual' scenario, without additional efforts to promote pro-poor development, some 653 million people would still be undernourished in 2030.

The decline in the share of agriculture in total production and employment would pose the challenges in agricultural investments and technological innovations across the regions. Further, the needed acceleration in productivity growth will be hampered by the degradation of natural resources, loss of biodiversity, climate change and the spread of transboundary pests and diseases of plants and animals. The critical parts of food systems will, thus, show the characteristics of 'capital-intensive', 'vertically integrated' and 'concentrated in fewer hands' across the agri-food value chain. Amongst other happenings, these can result in increased migratory flows of rural male that, in turn, lead to 'feminization' of agriculture.

All these trends poses severe challenges to the food and agriculture mainly in the forms of, for example, to: sustainably improve the agricultural productivity to meet increasing demand; eradicate extreme poverty, reduce inequality and end hunger and all forms of malnutrition; improve income earning opportunities in rural areas and address the root causes of migration; tackle those issues related to climate change and intensification of natural hazards, and ensure a sustainable natural resource base.

In the light of above, reorganizing of food systems and governance is of paramount importance to address the current and future challenges. It is indispensable to create innovative systems that protect and enhance the natural resource base, while increasing productivity and a transformative process towards 'holistic' approaches, such as Climate-Smart Agriculture, Conservation Agriculture, Agro-Ecology and Agro-Forestry, which also build upon indigenous and traditional knowledge.

PLENARY SPEECHES

ORGANIC AGRICULTURE WITH REFERENCE TO SRI LANKA

Ananda N. Jayakody

University of Peradeniya, Sri Lanka

ABSTRACT

Organic Agriculture considers the soil as a living body required for sustainable soil fertility, avoiding synthetic inputs for crop production, recognizing the triviality of environmental pollution and unhealthy food. Hence, the agronomic operations here are near natural and integrated. The key operations are use of compost, animal manure, green manure etc. as fertilizers, crop rotation, mixed cropping, companion planting etc. as cultivation systems and adoption of biological pest control methods. Use of growth regulators, hormones, genetically modified plant materials etc. is also excluded. Current procedures adopted are internationally regulated as per guidelines of International Federation of Organic Agriculture (IFOAM) established in 1972. The major agricultural production sectors of Sri Lanka are at plantation and small-holder levels. The producers in both are attempting to blend organic concepts to their present operations since 1979. There is an increasing local demand and products are also exported to Europe, America, Japan and Australia Spain etc. As the in local consumption is increasing, the organic growers have developed a Local Organic Product Certificate in consultations with well-wisher organizations and the relevant ministries. Thus, Sri Lanka has "Sri Cert" certification at present along with an organic product logo.

Though, perhaps, the Organic Agriculture would not be able to feed the nation quantitatively due to its marginal nature, the impression on food quality and environmental quality could be well advanced among the Sri Lankans.

Keywords: Organic Agriculture, Sri Lanka," Sri Cert", Soil Fertility

CLIMATE CHANGE & IMPACTS ON AGRICULTURE : SOME REMEDIAL APPROACHES FROM THE SRI LANKAN PERSPECTIVE

Rizvi Zaheed

Hayleys Agriculture Holdings Limited, Sri Lanka

ABSTRACT

Though recognition and acceptance of the phenomena of global warming is traced back to the 19th Century when the Swedish scientist Nobel laureate Svante Arrhenius propounded his theory in 1903 on the impact of carbon dioxide emissions on climate patterns, it is only in the 20th Century that serious study was made of the impact of climate change on agriculture. Repeatedly, the discussion on the role of commercial, intensive agriculture on contributing to climate change has also detracted on remedial approaches.

This presentation will seek to cover recent trends in rainfall and droughts and their impacts on agricultural outputs with special reference to Sri Lanka. With 30 percent of the population involved in agriculture, reduction in yields and incomes have had significant socio-economic and political implications. While some benefits have accrued from the influence of the Green Revolution from the mid-1960s particularly with the increase in paddy yields, climate change impacts have played havoc with farmer incomes and sustainable agriculture.

Critical changes in Agriculture and Agribusinesses will be assessed in Sri Lanka and the effects on farmer livelihoods and other stakeholders. The intermediate steps of a proactive and reactive nature will also be looked at.

The presentation will also explore some of the remedial approaches which have been adopted so far and those that could be looked at to mitigate the effects of climate change on agriculture with special reference to Sri Lanka.

ORAL PRESENTATIONS

A1 **[01]**

MICROBIAL ENUMERATION AND IDENTIFICATION OF DOMINANT LACTIC ACID BACTERIA OF *BATUAN* [*Garcinia binucao* (BLANCO) CHOISY] FRUIT DURING BRINE FERMENTATION

M.V. Capapas[1,2] and E.I. Dizon[1]

[1]*Institute of Food Science and Technology, College of Agriculture and Food Science, University of the Philippines- Los Baños, Philippines*

[2]*Southern Leyte State University-College of Agriculture and Environmental Sciences, Philippines*

ABSTRACT

Batuan is an indigenous and seasonal fruit in the Philippines, which locals usually add brine to enhance the flavor and extend the products shelf-life. This study was conducted to determine the effects of brine concentrations (5 and 10%) on the microbial population and dominant lactic acid bacteria (LAB) during 15 days fermentation. Microbiological analyses revealed that *batuan* fruits fermented with 5% brine concentration was significantly different in most parameters being studied specifically higher acid production, better assimilation of carbohydrates and higher microbial count for acid-producing bacteria, yeasts and general types of fermenting microorganisms. Nine isolates were phenotypically and genotypically identified as lactic acid bacteria (LAB). The dominant LAB during the fermentation process was *Lactobacillus plantarum* isolated during the 3rd, 6th, 9th and 15th day of fermentation for both brine concentrations. *Bacillus megaterium* was isolated during the 9th day at 10% brine concentration.

Keywords: Lactic Acid Bacteria (LAB), *Lactobacillus plantarum*, *Bacillus megaterium*, Microbial Enumeration

A2 **[02]**

ISOLATION AND IDENTIFICATION OF BACTERIA CAUSING LARVAL MORTALITIES IN HATCHERY REARED SEA HORSES (*Hippocampus kuda*) IN SRI LANKA

V.C. Bandara[1], D.K. Gunasena[1] and P.D.S. Weerasingha[1]

[1]*Department of Microbiology, Faculty of Science, University of Kelaniya, Sri Lanka*

ABSTRACT

Increased number of larval mortality of *Hippocampus kuda* was observed in sea horse hatchery at Pitipana Development Center in Sri Lanka. Larvae at different ages (2 days to 3 month old) showed inappetence, erratic swimming and rotational swimming but no external lesions. Bacterial flora of both rearing water and larvae samples (dead larvae and healthy larvae) were isolated and identified based on the morphological and biochemical tests. Total bacterial count was significantly high in dead larvae sample and *Vibrio* spp were prominent (about 75%).V. *algainolyticus, V. splendidus, V. paraheamolyticus* and *V. mimicus* were identified as possible pathogenic bacteria and other non-vibrios were *Aeromonashydrophila* and *Plesiomonasshigelloides*. The same bacterial species were identified in rear water along with several other species, *V. fluialis, Bacillus circulans* and *Micrococcus leteus*. To confirm the pathogenicity of *V. algainolyticus* and *V. splendidus*, immersion challenge was conducted and Koch's postulate was verified under laboratory conditions. It was found that 1x106 CFU/mL of bacteria was the minimum dose for causing the disease. Kirby-Bauer disc diffusion method confirmed that *V. algainolyticus* was sensitive to chloramphenicol and ampicillin while *V. splendidus* was sensitive to tetracycline and erythromycine.

Keywords: *Hippocampus kuda*, Vibrio, Hatchery Reared

A3 **[03]**

DEVELOPMENT OF SHORT DURATION & DROUGHT TOLERANT MUSTARD CANOLA FOR THE FOOD SECURITY OF ARID AREAS

H.S.B. Mustafa[1], T. Mahmood[1]and M. Aftab[1]

[1]*Directorate of Oilseeds, Ayub Agricultural Research Institute, Pakistan*

ABSTRACT

Food security is the crucial global issue, especially in developing countries like Pakistan. Edible oil requirement of Pakistan is accomplished through huge import of low quality palm oil. The aim of present study is qualitative and quantitative evaluation of short duration and drought tolerant *Brassica juncea* lines ZBJ-06012 and ZBJ-08051 having canola quality developed through pedigree method of plant breeding. Thirteen lines were evaluated in randomized complete block design (RCBD) for seed yield, oil quality, maturity period and drought tolerance under different agro-climatic zones both in irrigated and arid areas across the Punjab province at eight locations during winter 2012-13 and 2013-14. Presently, grown non-canola mustard varieties Khanpur Raya and Anmol Raya were used as check varieties. *Brassica napus* cultivars Punjab canola and Faisal canola were also included in the trials for comparison study of mustard and rapeseed genotypes. Data for all traits under observation was analyzed through Principle Component Analysis (PCA) to evaluate the best performing lines in irrigated as well as in rain fed areas. Principal Component Analysis showed first 2 PCs having Eigen value >1 explaining 76.4% and 72% of the total variation at irrigated areas and rain fed areas respectively. The mean seed yield was also compared by Least Significant Difference (LSD) test to study the significance at 5% probability level. Canola quality *B. juncea* lines ZBJ-06012 and ZBJ-08051 have shown good adaptability, early maturity, non-shattering, disease and drought tolerance traits with high yield potential in comparison with presently grown *Brassica napus* cultivars "Punjab Canola" and "Faisal Canola". Due to these prominent features, these lines have a great scope for motivating farmers to grow canola quality *B. juncea* in arid areas which will ultimately enhance edible oil production in the country.

Keywords: *B. juncea*, Drought Tolerance, Food Security, Genetic Variability, Short Duration

A4 **[04]**

IN VITRO ANTIBACTERIAL EFFECT OF CHITOSAN ON *Staphylococcus aureus* TO AID IN FOOD PRESERVATION

F.A. Hussain[1] and D.K. Gunasena[1]

[1]*Department of Microbiology, Faculty of Science, University of Kelaniya, Sri Lanka*

ABSTRACT

Chitosan, a natural biopolymer has been investigated for its antimicrobial activity and confirmed as a possible food preservative material. In Sri Lanka, *Staphylococcus aureus* is a common food borne pathogen and it has contributed to many foodborne outbreaks throughout the country. With this in mind, antibacterial effect of chitosan on *S. aureus* ATCC25923 was investigated *in vitro.*

Growth inhibition of *S. aureus* was explored by growing mid-exponential cultures in a nutrient broth media supplemented with different concentrations of chitosan (0.00%, 0.5%, 1.00% and 1.5%). Viable cell counts in those growth media were taken at different time intervals (Day 0, Day 2, Day 4 and Day 6) using standard spread plate method. Two-tailed t-test was used to analyze the data statistically and found all three chitosan concentrations (0.5%, 1.00% and 1.5%) reduced viable cell count within 6 days. First four days showed a rapid decline from 8.4 Log CFU/ml and reduction continued upto 3.0-4.0 Log CFU/mL within next two days while typical bacterial growth curve was observed for the chitosan free culture.

The study successfully demonstrated the antibacterial effect of chitosan on the growth of *S. aureus* and the effectiveness increases with the increased concentration of chitosan.

Keywords: *Staphylococcus aureus*, Chitosan, Natural Food Preservative

A5 **[05]**

DEVELOPMENT OF GLYPHOSATE-TOLERANT TRANSGENIC POTATO PLANTS HARBORING THE G2AROA GENE

A. Ali

FB, Genetics, Biotechnology Lab, Four Brothers Group Limited, Pakistan

ABSTRACT

Glyphosate weed control is a very effective strategy to minimize cost and improve economic outcomes of world and Pakistan agriculture production. Development of glyphosate -resistant potato hold great promise. A new G2-aoraA gene from Pseudomonas florescence which encodes 5-enolpyruvylshikimate-3-phosphate synthase (EPSPS) was transformed by using an Agrobacterium-mediated transformation into potato cultivate AGB-Red. Transgenic potato plants were generated vis node tissue culture method using kanamycin selection. Ten regenerated potato plants were obtained and allowed to grow normally in pots under normal conditions. The Polymerase chain reaction (PCR), southern blotting and Westron Blotting analysis confirmed that the target gene was integrated and expressed effectively into potato chromosomes at the very potential level. The Glyphosate tolerance assay showed that transgenic potato had a high resistance level to glyphosate. Furthermore, potato plants treated with 50.0 mmolL of glyphosate could grow slowly and can develop tubers. It was concluded that transgenic potato may be used for cotton breeding research of glyphosate -tolerant potato.

A6 **[06]**

EFFICACY OF VERMIWASH, NEEM EXTRACTS AND COMMERCIAL PESTICIDE ON BRINJAL PLANT (*Solanum melongena* L.) IN JAFFNA, SRI LANKA

R. Nithiyagowry[1] and S. Bremavanitha[1]

[1]*Department of Zoology, University of Jaffna, Sri Lanka*

ABSTRACT

The efficacy of vermiwash, aqueous neem seed kernel extract, aqueous neem leaf extract and conventional pesticide Coragen® was assessed on the basis of growth and yield of brinjal plants and pest infestation. Pot culture study was conducted. Brinjal seedlings was planted in separate pots grouped into five and treated as follows vermiwash (100%), Aqueous neem seed kernel extract (50g/l), aqueous neem leaf extract (1:5w/v), commercial pesticide Coragen and tap water for control at weekly intervals. Each was replicated ten times along with the control. The parameters shoot length, number of leaves , yield of plants and number of pests were noted once a week. From the LSD test, the results revealed that application of vermiwash was significantly enhanced the growth parameters plant height , number of leaves and yield parameters number of fruits per plant and followed by aqueous neem seed kernel extract, aqueous neem leaf extract, coragen than the control. From the results it could be seen that the foliar spray of vermiwash and neem extract can be economically and environmentally suitable for the soil environment when compared with conventional pesticides. Therefore, it could be concluded that significant increase in growth of plants treated with vermiwash, neem extract and their yield is due to nutrients available in the vermiwash and neem extract and vermiwash and neem extract found to be as good fertilizer and bio pesticide.

Keywords: Vermiwash, Neem Seed Kernel Extract, Neem Leaf Extract, Coragen, Brinjal

A7 **[07]**

ANTIBACTERIAL EFFECT OF CHITOSAN AGAINST *Staphylococcus aureus* CONTAMINATIONS OF DOMESTIC CHICKEN (*Gallus gallus*) EGGS

B.G.E.T. Jayashantha[1] and D.K. Gunasena[1]

Department of Microbiology, Faculty of science, University of Kelaniya, Sri Lanka

ABSTRACT

Chitosan is a modified, polycationic, natural biopolymer synthesized from deacetylation of chitin, a plant and animal waste material. Recently, chitosan has received more attention for commercial use in food industry due to its antimicrobial activity and edible-films formation ability. In this study, chitosan as a natural coating preservative material for village chicken eggs against foodborne pathogen *Staphylococcus aureus* was investigated. Randomly selected, 5 samples of five-pooled Village chicken eggs from Kiribathgoda area were investigated for *Staphylococcus aureus* using ISO 6888-1:1999 standard procedure and found out that all samples were highly contaminated with *S. aureus* (>5 log CFU/mL). An experiment was performed to investigate whether chitosan reduce this contamination. Randomly selected 90 eggs were tested in three groups as [A] Raw eggs treated with 70% ethanol), [B] Chitosan non-coated eggs and [C] Chitosan coated (1.5% chitosan) eggs. Eggs of [B] and [C] groups were externally inoculated with ~ 5 log CFU/mL of *S. aureus* inoculum. All eggs were incubated at 37 °C ± 1 °C. Eggs were tested (in six-pooled eggs) for *S. aureus* counts in every week for 28 days period. Chitosan showed a bacteriostatic activity with 4 log CFU/mL fold growth reduction compared to chitosan non-coated eggs [B] and 3 log CFU/mL fold growth reduction compared to the raw eggs [A]. Therefore, it was confirmed that 1.5% chitosan can be used as an antibacterial food preservative outer coating for village chicken eggs.

Keywords: Chitosan, *Staphylococcus aureus*, Preservation, Chicken Eggs

B1 **[08]**

MORPHOGENETIC VARIABILITY IN *Rhizoctonia solani* AND BIOCHEMICAL CHARACTERIZATION OF BROWN SEAWEED ALGAE AND ITS EFFICACY ON MANAGEMENT OF RICE SHEATH BLIGHT

T.S. Raj[1], K.H. Graff[1], D.J. Christopher[1] and H.A. Suji[2]

[1]*Department of Plant Pathology, Faculty of Agriculture, Annamalai University, India*

[2]*Centre for Advance Studies in Marine Biology, Annamalai University, India*

ABSTRACT

Sheath blight disease of rice is one of the vital issues which exist in rice production which is caused by *Rhizoctonia solani*. The ultimate way of controlling this disease is done using natural means and products. There are twenty isolates of *Rhizoctonia solani* found and collected from various rice growing regions in Tamilnadu, which indicates the existence of various virulences. The morphogenetic relationship between twenty isolates is seen as *R. solani* which was tested using random amplified polymorphic DNA (RAPD) analysis. Molecular polymorphism generated by RAPD which established the variation in virulences of *R. solani* and different isolates, is grouped into two large clusters. While doing the pathological study of isolates and RAPD grouping, these don't have any correlation among the test isolates. In this situation five different seaweeds such as *Sargassum wightii, Sargassum muticum, Dictyota bartyrensiana, Padina gymospora,* and *Chnoospora implexa* were analysed with the aim of controlling sheath blight disease in rice. Spore germination assay, Paper disc assay and Agar well method were carried out for the evaluation of seaweed extracts against *R. solani*. Among the five seaweed extracts tested, extracts of *Sargassum wightii* [brown seaweed algae] was found with a higher concentration and (20%) was found to be the most excellent in the reduction of spore germination (19.60 %). The extract of *Sargassum wightii* [brown seaweed] showed an utmost reduction in both paper disc method and agar well method with 44.65 and 45.90 per cent zone of inhibition respectively. In this present study, it is portrayed that the efficacy of seaweed extracts against sheath blight of rice may be due to early gathering of phenolics and phytoalexins and the field studies proved that the sheath blight disease can be managed by the application of brown seaweed.

Keywords: Antifungal Compounds, Seaweeds, *Rhizoctonia solani*, RAPD, GCeMS

B2 **[09]**

FIRST REPORT OF BIG ONION FLOWER MOLD CAUSED BY *Aspergillus niger* ON *Allium cepa* L. IN SRI LANKA

W.M.K. Fernando[1], R.S.W. Wijeratnam[2], D.M.J.B. Senanayake[3], C.M. Nanayakkara[4], W.A.R. Dhammika[1], W.M.W. Weerakoon[5], A.M. Perera[1], W.M.S.D.K.Wijerathne[1] and D.M.K. Dissanayake[1]

[1]*Field Crops Research and Development Institute, Mahailluppallama, Sri Lanka*

[2]*Industrial Technology Institute, Colombo, Sri Lanka*

[3]*Plant Genetic Resource Centre, Gannoruwa, Sri Lanka*

[4] *Faculty of Sciences, University of Colombo, Sri Lanka*

[5]*Department of Agriculture, Sri Lanka*

ABSTRACT

Big onion is a main cash crop grown in Sri Lanka. However, the crop is highly susceptible to diseases: anthracnose, purple blotch, bulb rot and black mold. Although black mold disease symptoms are associated with the onion bulb, black moldy growth on onion flowers has been observed to be spreading in Sri Lanka during the last decade resulting in the reduction of quantity and quality of onion seeds. Hence, this study was conducted with the objective of isolation and identification of causal agents of the onion flower mold. Big onion flower samples with mold symptoms were collected during Maha season 2016/17 from the major onion growing areas of Anuradhapura and Matale districts. Four organisms were isolated from onion flower: Aspergillus, Penicillium, Collectrotichum and Altenaria. Out of the four, Aspergillus dominated. Hence, Aspergillus sp. isolated from onion flowers was compared with the causative agent of black mold of onion bulbs. Koch's postulation studies of flower and bulb inoculation with respective Aspergillus isolates resulted the same black color molds in the flower and bulb Inoculation of other fungal isolates did not show the black old symptoms in flower and bulb. PCR amplification with ITS1/ITS4 universal primers confirmed the isolated Aspergillus from flower as well as bulb are to be A. niger. Results confirmed that the onion flower black mould disease is caused by A. niger: the causal organism of onion bulb black mold as well.

Keywords: Aspergillus, Black mold, Flower, Onion, Sri Lanka

B3 **[10]**

RED DRAGON FRUIT (*Hylocereus polyrhizus*) PEEL EXTRACT AS EDIBLE COATING TO CONTROL ANTHRACNOSE DISEASE ON CHILI FRUIT

N.I. Wibiani[1], B.U. Putra[1], S.Y. Sunarya[1], N.E. Amanatillah[1], Yulianto[1] and B.P.W. Soekarno[1]

[1]*Department of Plant Protection, Faculty of Agriculture, Bogor Agricultural University, Indonesia*

ABSTRACT

Anthracnose caused by *Colletotrichum* spp. is a major disease of chili which causes damage to both preharvest and postharvest stage. Coating on postharvest products as an alternative control can be done during postharvest processing. This study was aimed to determine the effectiveness of red dragon fruit peel extract as an edible coating in controlling fungal pathogen causing anthracnose of chili. Anthracnose pathogen was isolated from chili collected from Cianjur, West Java. *In vitro* test was conducted using the poisoned media with concentration 0.25%, 0.5%, 1%, 2% and 4%. Negative control, *Colletotrichum acutatum* isolates were grown on PDA without treatment, whereas for positive control, *C. acutatum* were grown on PDA which was added by benomil fungicide at concentration of 2 gl^{-1}. The results of the test showed that ethanol extract of red dragon fruit peel with concentration of 4% was effective in suppressing colony growth of *C. acutatum* up to 25.65% and were able to inhibit sporulation compared to control. The result of the Gas Chromatography - Mass Spectrophotometer analysis showed that ethanol extract of red dragon fruit peels contains antifungal activity compounds i.e *acetic acid* (6.05%), *3-butenoic acid* (5.55%), and *myrcenol* (11.94%). Ethanol extract application of red dragon fruit peel as an edible coating able to suppress the disease severity from 72.38% to 43.81% and extend the incubation period from 3.00 to 4.19 days.

Keywords: Antimicrobial, GC-MS Analysis, Polysaccharides, Secondary Metabolite

B4 **[11]**

PELACK (PEST REPELLENT SACK) : ALTERNATIVE CONTROL FOR STORAGE PESTS ALTERNATIF

W. Surya[1], N. Kusumawardany[1], M.G.S. Adinata[1], S. Yusuf [1] and K. Laia[1]

[1]*Bogor Agricultural University, Indonesia*

ABSTRACT

Storage pests are organisms that can destroy or contaminate commodities during storage. Insect storage pests often come from the Coleopteran order. The species used in this study were *Sitophilus* sp. and *Callosobruchus* sp. Storage pest control is generally done by fumigation and surface spraying with contact poison. In addition, storage pest can also be managed by placing insecticide directly into the sacks used to contain a commodity. In this study the insecticides used are derived from botanical insecticide, namely lemongrass essential oil, commercial lemongrass oil, and conventional lemongrass oil. The purpose of this study to determine the effectiveness of botanical pesticides application on gunny sacks in storage pest control. The research was conducted by testing insecticides' repellency using Y-Olfactometer and the effectiveness of repellent sack. Repellency test using Y- Olfactometer was performed to determine the most effective concentration of plant-based insecticides, while repellent sack test was conducted to determine the most effective type of botanical insecticide. The results of repellency test using Y- Olfactometer showed that the effective concentration of lemongrass essential oil, commercial lemongrass oil, and conventional lemongrass oil are 5%, 5%, and 20%, respectively. These concentrations were then used for repellent sacks testing. Repellent sacks test results showed that the most effective type of botanical insecticide to control *Sitophilus* sp. is the lemongrass essential oil with a percentage of 7%, while the most effective treatment to control *Callosobruchus* sp. is the control treatment with a percentage of 1%. This is because the control treatment is contaminated. Both of these results indicate that gunny sacks treated with plant-based insecticides can be used as storage pest repellent.

Keywords: Botanical Insecticide, *Callsobruchus* sp., Gunny Sack, *Sitophilus* sp., Storage

B5 **[12]**

SURVEY ON APPLE PRODUCTION AND VARIETY IDENTIFICATION IN CHENCHA DISTRICT OF GAMO GOFA ZONE, SOUTHERN ETHIOPIA

S. Fetena

Arba Minch University, Ethiopia

ABSTRACT

Apple (*Malus domestica*) is one of the most important temperate fruits grown in the highland climates of Ethiopia by virtue of high altitude. Chencha district in the Southern region hosted the first apple trees introduced to Ethiopia and grown for a long time; however, the achievements from apple production so far remained minimal. There is inadequate information on productivity and variety identification. Therefore, a survey on productivity and variety identification of introduced apple trees in Chencha district of Gamo Gofa Zone was carried out in 2013/14 cropping season. The study was aimed to assess status of apple production and productivity, investigate apple tree management practices carried out by the growers and identify apple varieties and rootstocks. A total of 181 randomly selected respondents were interviewed using semi-structured questionnaire from nine administrative units (kebeles). Results of the survey showed that farmers lacked knowledge on importance of the crop and did not invest in good crop management as it demands revealing that the fruit tree was neglected by research and development. For most farmers, land holding size was estimated to be below 0.25 hectare. Due to very low level of the fruit tree management practices farmers applied, fruit yield was found to be in the range of 4.2 - 8.3 tons per hectare as comparison to 40-60 tons per hectare achievable in good growth conditions somewhere else in the world. A total of sixty apple varieties were identified in the study area, out of which Bonded Red (BR), Crispin, Grany smith, Jonagored and Red delicious were extensively cultivated. MM106 is reported as a good root stock in the study area. Therefore, applied research on agronomic packages for improving productivity, identification of best varieties for Chencha and similar agro-ecology should be promoted through field trials; communication on current knowledge and sharing of information on interventions in production of apple is recommended.

Keywords: Apple, Productivity, Variety Identification, Chencha, Management Practices

B6 **[13]**

INTROGRESSION OF *LYSOZYME* GENE FROM TRANSGENIC LINE OF JAPONICA RICE INTO ELITE INDICA RICE TO INCREASE RESISTANCE OF BACTERIAL LEAF BLIGHT

A. Eka[1,2], Suharsono[1,2] and Miftahudin[1]

[1]*Department of Biology, Bogor Agricultural University Kampus IPB Dramaga, Indonesia*

[2]*Biotechnology Research Indonesian-The Netherlands (BIORIN) Kampus IPB Dramaga, Indonesia*

ABSTRACT

Bacterial leaf blight caused by *Xanthomonas oryzae pv. oryzae* (*Xoo)* infection is one of the most destructive diseases to the rice crops. One of the efforts to control BLB is by using resistant varieties. Resistant varieties present in nature usually consist only of a single resistance gene (R gene) so their resistance properties are easily breakdown by the ability of *Xoo* bacteria to form new mutants, more virulent strains. The creation of new varieties that are resistant to the entire *Xoo* spectrum and can survive for long periods is obtained by expressing genes from foreign organisms (transgenes) that encode antimicrobial compounds into rice plants. *Lysozyme* is an ubiquitous enzyme known to possess the ability to hydrolyze the β-1,4 glycoside bond between N-acetylmuramic and N-acetylglucosamine found in bacterial peptidoglycan cell wall, both in gram-positive and gram-negative bacteria. However, indica rice is still remain less amenable to genetic modifications due to their poor regeneration potential. Obtention of indica rice that has *lys* gene can be done by crossing with the transgenic japonica rice. Transgenic japonica rice is more responsive to transformation. Ciherang is an elite indica rice cultivated in Indonesia. The crossing of transgenic rice Kinlys 1/3/23 carrying the *lys* gene with Ciherang has been successfully done. The analysis of integration of lys gene using PCR showed that F1 plants carry the *lys* gene. Combination of genetic engineering and convensional breeding can be use as an alternative for genes transfer in indica rice.

Keywords: Bacterial Leaf Blight, *Lysozyme*, Introgression, Transgenic Rice

B7 **[14]**

STATUS OF CHILLI LEAF CURL VIRUS AND PEST POPULATION DYNAMICS WITH VARYING MICRO ENVIRONMENT UNDER DIFFERENT SHADE LEVELS

W.M.K Fernando[1], M.S. Nijamudeen[1], K.N.C. Gunewardena, W.M.W. Weerakoon[2], W.M.S.D.K. Wijerathne[1] and D.M.K. Dissanayake[1]

[1]Field Crops Research and Development Institute, Mahailluppalama, Sri Lanka

[2]Department of Agriculture, Peradeniya, Sri Lanka

ABSTRACT

In Sri Lanka, chilli leaf curl virus (CLCV) which is transmitted by white fly (*Bemisia tabaci*) is a serious problem in chilli cultivation. Management of CLCV only by chemical application is not economical and sustainable. It is important to identify alternative agronomic practices to control CLCV. Hence, experiments were conducted during 2015-2016 at the research institute, Mahailluppallama, Sri Lanka with the objective of studying the effect of different shade levels on CLCV and pest populations. Two varieties; local hybrid (MICHHY 01) and exotic hybrid (Vijaya) were tested with five shade levels; 0, 40, 50, 60 and 70%. There were no considerable differences in environment temperature and relative humidity among shade levels. Slight reduction of canopy and soil temperature were observed with increasing shade. Lower canopy and soil temperature were recorded under shade nets compared to the open field. There was no significant difference in white fly population between two varieties. However, whitefly population significantly increased with increasing shade ranging from 50-75%. Mites population also increased with the increasing shade. Severity of CLCV was significantly low in MICHHY 01 compared to Vijaya and it was increased with increasing shade up to 45- 57% compared to open environment. Reduction of yield was observed under shade compared to the open field. Findings revealed that chilli cultivation under shade nets enhance the CLCV and mites damage.

Keywords: Chilli, Environment, Pest, Shade, Virus

C1 **[15]**

INCREASING PLANTING DENSITIES TO ENHANCE THE ECOLOGICAL BENEFITS OF SUNN HEMP (*Crotalaria juncea* L.) AS A GREEN MANURE CROP

D.I.D.S. Benaragama[1], D.A.U.D. Devasinghe [1], D.M.D. Dissanayake[1], C.N. Gunarathne[1], P.L.P.B. Nishantha[1] and J.P.H.U. Jayanetthi[2]

[1]*Department of Plant Sciences, Faculty of Agriculture, Rajarata University of Sri Lanka, Sri Lanka*

[2]*Department of Agricultural Engineering and Soil Sciences, Faculty of Agriculture, Rajarata University of Sri Lanka, Sri Lanka*

ABSTRACT

Inclusion of green manure crops in the fallow period in the rice-based crop rotations is widely known as a sustainable practice as it provide many ecological functions, including, enhancing soil fertility, weed suppression, and biological nitrogen fixation. Still, less attention has been given to optimise the multiple ecological benefits of green manure crops using different cultural practices. A field experiment was carried out to evaluate the effect of increasing planting densities of sunn hemp on increasing soil fertility and weed suppression. Three seeding rates of sunn hemp (20, 40, 80 kg/ha) with a fallow control was carried out with eight replicates in a randomized complete block design during May-July 2017 at the Faculty of Agriculture, Rajarata University of Sri Lanka. Sunn hemp biomass, weed biomass and density and some soil chemical and biological properties were estimated. Increasing the seeding rate from 20 kg/ha (recommended) to 80 kg/ha significantly ($P < 0.05$) increased the sunn hemp shoot biomass by 9%. Increasing the sunn hemp seeding rate to 80 kg/ha from 20 kg/ha significantly ($P < 0.05$) reduced weed density and weed biomass. Compared to the fallow, sunn hemp at 20 kg/ha increased the soil biomass carbon, microbial activity, organic matter content, available nitrogen, available phosphorous and extractable potassium contents. Further increasing the seeding rate up to 80 kg/ha increased ($P < 0.05$) the above parameters by 10-15% but was not different from 40 kg/ha rate. Overall, this study confirmed that increasing the sunn hemp seeding rates to 40 kg/ha could be a sustainable practice during the fallow.

Keywords: Crop Rotation, Green Manure, Planting Density, Soil Fertility, Weed Management

C2 **[16]**

'B-M MODEL' FOR FARMERS' KNOWLEDGE MANAGEMENT IN INCREASING RICE PRODUCTION

M. Bidyuth[1], A. Bashir[2], B. Humnath[3] and S. Moin U.[4]

[1]USAID-AESA Project, Bangladesh

[2]Khulna University, Bangladesh

[3]International Rice Research Institute (IRRI) Bangladesh Office, Bangladesh

[4]Bangladesh Rice Research Institute (BRRI), Bangladesh

ABSTRACT

While many knowledge-based systems exist for farmers' decision support, specific models are lacking on how knowledge traits can impact on agricultural production systems. This study employed modelling technique to provide a clear understanding and quantifying how knowledge management in production practices can contribute to rice productivity in the environmentally stressed southwest Bangladesh accounting for 'Boro' rice and 'BRRI dhan28' as the test variety. The 'B-M Model' was developed where three Knowledge Management Traits (KMT) were defined and quantified as the inputs of the model. Those are: Self-Experience and Observation (SEO), Extension Advisory Services (EAS) and Accessed Information Sources (AIS). The Yield Influencing Process (YIP), the intermediate state variable of the model, was deduced by accounting for the two dominant agronomic practices, seedling age for transplanting and Triple Superphosphate (TSP) application. 'Knowledge drives farmers' practice change which in turn influences yield' was composed as the theoretical framework of the 'B-M Model'. The model performed strongly against independently collected field dataset. Across the 180 farmers' data, the average Relative Rice Yield (RRY) predicted by the model and observed in the field was close (Root Mean Squired Deviation (RMSD) = 0.018). A regression of predicted and observed RRY explained 96% variance in observation, further proving the model's strength in estimating RRY in wider range of farmers' rice yields. It is concluded that the model has the potential to be used for identifying quantitative pathways of farmers' knowledge acquisition for practice change leading to improved productivity of rice in the southwest region of Bangladesh.

Keywords: B-M Model, Knowledge, Self-Experience, Information, Trait, Pool

C3 **[17]**

EFFECT OF DIFFERENT CONCENTRATIONS OF WOOD VINEGAR ON GROWTH AND YIELD GREEN GRAM (*Vigna radiate (L)*)

B.P. Siriwardena[1], P.W.A.C. Jayalath[1], T.G.B. Dhanushka[1], M.D.D.P. Aruna[1] and N.P. Vidanapathirane[1]

[1]*University of Colombo Institute for Agro – Technology and Rural Sciences, University of Colombo, Sri Lanka*

ABSTRACT

The Green gram (*Vigna radiate (L))* is popular among Sri Lankan farmers due to its commercial value and nutritional value. Due to indiscriminate use of agro chemicals people have faced lot of environmental and health issues. Wood vinegar is an organic liquid which is accelerate plant growth performances and also act as a repellent for pest and diseases. Aim of this research was to study the effect of different concentrations of wood vinegar on growth and yield of Green gram. Four different concentrations used as treatments (T1-1: 0, T2-1:200, T3-1:400, T4-1:500) and the design was Complete Randomized Design (CRD) with three replicates. Height of the plant, number of leaves per plant, number of pods per plant, number of flowers per plant, number of pest and disease attacks on leaves and pods, number of nodules at 50% flowering, dry weight of roots and shoots, yield per hectare, brown and unfilled seeds per pod and 100 seed weight were considered as growth and yield parameters. According to the results, treatment number 4 (wood vinegar: water, 1:500 (T4)) has given the best results for growth and yield. Pest and disease incidences were reduced in the plants with the treatment number 2 having highest concentration of wood vinegar (wood vinegar: water, 1:200 (T2)). Referring to all findings it reveals that the lower concentrations of wood vinegar is directly affect to the growth and yield of Green gram and higher concentrations directly affects to the reducing the pest and disease conditions.

Keywords: Wood Vinegar, Pest, Diseases, Yield, Organic, Growth

C4 **[18]**

PRODUCTIVITY AND PROFITABILITY OF SUNFLOWER (*Helianthus annuus* L.) HYBRIDS UNDER SPRING PLANTING CONDITIONS FOR OILSEED SECURITY IN INDIA

M.S. Pal

G B Pant University of Agriculture & Technology, India

ABSTRACT

Field experiment was carried out at Borlaug Crop Research Centre, G B Pant University of Agriculture & Technology, Pantnagar (India) in spring season 2016 and 2017 to evaluate the performance of sunflower hybrids in Indo-Gangetic plains of India to enhance the oilseed security of the country. The experimental site was sandy loam in texture having soil pH 7.2, organic carbon 0.85%, available nitrogen, phosphorus and potassium 224, 19.5 and 268 kg/ha, respectively. Sunflower hybrids differed significantly in growth and yield attributes, seed yield, oil content and economics. Among hybrids, DRSH-1, KBSH-44 and LSFH-187 had taller plants. The number of leaves/pl was recorded maximum in KBSH-44 followed by LSFH-171, KBSH-53 and RSFH-1887 based on two years average. The highest average stem girth was measured in KBSH-44 followed by DRSH-1. The highest average head diameter was recorded in DRSH-1 followed by RSFH-130. The highest average 100 seed weight was weighed in DRSH-1 and LSFH-171. Hybrid RSFH-130 produced highest average seed yield followed by DRSH-1. Hybrid RSFH-130 gave 6.8 and 11.2% higher seed yield than DRSH-1 and PSH-1962, respectively. Hybrid PSH-1962 is a dwarf and early maturing variety and can be fitted into different cropping system and its yield and early maturity help it to be fitted into different cropping system and its yield potential is almost comparable to other hybrids and producing only 10% lower seed yield than RSFH-130, the highest yielding sunflower hybrid but saved 5 days. In addition, RSFH-130 is a taller variety and prone to lodging during heavy winds in summer. The highest average oil content was recorded in LSFH-171 followed by RSFH-130. The average of two years indicated that RSFH-1887 had the highest gross, net returns and B:C ratio and closely followed by RSFH-130 and DRSH-1. It is therefore concluded that sunflower hybrids LSFH-171, RSFH-1887 and DRSH-1 may be grown in spring season in whole Indo-Gangetic plains of India for higher productivity, profitability and oil security. However PSH-1962 may be the best option in areas where there is a risk of heavy wind/cyclones during spring/summer season as low risk of lodging.

Keywords: Hybrids, Oil Security, Productivity, Profitability, Spring/Summer, Sunflower

C5 **[19]**

CHANGE IN SEED YIELD ATTRIBUTING CHARACTERS IN RICE (ORIYZA SATIVA) UNDER ELEVATED TEMPERATURE CONDITIONS AND THE EFFECT OF MITIGATION TREATMENTS

V. Vakeswarn[1], C. Menaka[1] and P. Selvaraju[1]

[1]*Seed Centre, Tamil Nadu Agricultural University, Coimbatore, India*

ABSTRACT

Under the change in environment condition, the increase in temperature is one of the threatening factors for agricultural productivity. This increased temperature modifies the plant geometry and growth of the crops. Rice is the major staple crop in Asia and the change in productivity by this elevated temperature has direct impact on socio economic status in this region. In this study, the change in plant growth attributing characters were studied. The tillering pattern in terms of primary, secondary, tertiary, late formed and flowering pattern in terms of numbers of spikelets opened per day, duration of flowering in primary, secondary and tertiary tillers and seed filling duration were studied under normal and elevated temperature conditions. There was significant impact on number of tillers, plant height and flowering pattern under elevated temperature. To mitigate the effect of elevated temperature on seed yield, different foliar spray treatments were imposed and it observed that the foliar spray with Brassinolide on flower initiation and 50 per cent flowering stage minimizes the effect of elevated temperature. The seed set and the resultant seed quality was superior with Brassinilide foliar spray.

Keywords: Rice, Seed yield attributing characters, Elevated temperature, Mitigation

D1 **[19]**

SCREENING OF PHENOL CATABOLIC GENES IN BACTERIA ISOLATED FROM SRI LANKAN PETROLEUM CONTAMINATED SITES

M.P. Dassanayaka[1], K. Vivehananthan[2] and G.H.C.M. Hettiarachchi[3]

[1]Department of Biotechnology, Faculty of Agriculture and Plantation Management, Wayamba University of Sri Lanka, Sri Lanka

[2]Department of Basic Sciences, Faculty of Health Sciences, The Open University of Sri Lanka, Sri Lanka

[3]Department of Chemistry, Faculty of Science, University of Colombo, Sri Lanka

ABSTRACT

Aerobic phenol degradation by bacteria are characterized by initial ring activation followed by enzymatic cleavage in ortho-fission or meta-fission pathway. The three key enzymes involve in these catabolizing pathways are Phenol hydroxylase, catechol 1, 2 – dioxygenase (C12O) and catechol 2, 3 – dioxygenase (C23O). Screening and characterization of genes responsible for these three enzymes in bacteria will confirm their biodegradation potential. The present study focused to screen of *LmpH* gene coding large subunit of multicomponent Phenol Hydroxylase, *catA* gene coding C12O and *xylE* gene coding C23O in bacteria isolated from petroleum contaminated sites in Sri Lanka which have already been proved for biodegrading of phenol in Mineral Salt Media containing phenol as the sole carbon source. The identified bacteria were screened for the catabolic genes by Polymerase Chain Reactions (PCR) using specific primer sets amplifying the three different genes. Amplified products were sequenced and characterize by NCBI – BLAST tool. Among the eighteen identified bacteria which showed the complete degradation of high concentrations of phenol (≥1600 mg/L), 15 different bacteria were belonged to the genera of, *Pseudomonas, Alkaligen, Klebsiella, Ochrobactrum, Fictibacillus* and *Rhizobium.* Three isolated bacteria; *Pseudomonas aeruginosa*, *Pseudomonas monteilii* and *Ochrobactrum grignonense* showed PCR amplification with primers of *LmpH* gene. Only *Klebsiella pneumoniae* showed PCR amplification with designed *catA* specific primers. The sequenced product showed ≥95% homologous for both respective genes. There was no successful specific amplification with primers of *xylE* genes in any bacteria. In conclusion, presence of catabolic genes responsible for phenol catabolism in isolated bacteria confirm their potential of phenol degradation. However, further studies are needed to confirm their level of expression of those genes in the isolated bacteria.

Keywords: Catabolic Genes, Phenol Bio- Degraders, Petroleum Waste, Wastewater

D2 **[20]**

IMPACT OF NITROGEN BASED CHEMICAL FERTILIZER APPLICATION ON THE GREY WATER FOOTPRINT OF PADDY CULTIVATION IN INTERMEDIATE ZONE, SRI LANKA

M.P.G.N.M. Palliyaguru[1], C.M. Navaratne[2] , D.D. Wickramasinghe[3] and C.M. Nanayakkara[4]

[1]Laboratory Services Division, Sri Lanka Standards Institution, Sri Lanka

[2]Department of Agricultural Engineering, Faculty of Agriculture, University of Ruhuna, Sri Lanka

[3]Department of Zoology, Faculty of Science, University of Colombo, Sri Lanka

[4]Department of Plant Science, Faculty of Science, University of Colombo, Sri Lanka

ABSTRACT

Agriculture, as the single largest use of freshwater resources and major cause of degradation of surface and groundwater through chemical runoff and leaching in defuse way, has cause to be concerned about the global implications of water quality. The grey water footprint (GWF) of crop production, which is a quantitative arithmetic method and useful indicator for to water pollution in agriculture although there are no method to direct calculation or control measures. This study was designed to quantify the GWF for nitrogen which is the most significant and common pollutant in paddy cultivation. A experiment was carried out in a selected location at Rice Research and Development Institute in Low Country Intermediate Zone, Sri Lanka for four consecutive growing seasons from 2015 to 2016. The lechate form the study plots were collected using non-weighable lysimeter arranged in a randomized block design with three replicates and analyzed for NO_3 content. The study was shown that the highest concentration of nitrate in leached water was 18.0 mg/L, were not exceed the WHO limits, 50 mg/L(as NO^{-3}). Estimated GWF for the site for Yala was 206 ± 13 m^3/t , for Maha was 172 ± 49 m^3/t. Seasons were significantly impacted on nitrate contents of drained water ($P<0.05$), otherwise not on GWF. The wastewater generated from the paddy cultivation in the given settings did not exceed the standard levels for nitrates, though it contributes the considerable amount of GWF. It was revealed that nitrogen losses from paddy cultivation in RRDI may not impact on water bodies where the recommended fertilizer levels are carefully applied for paddy field.

Keywords: Grey Water Footprint, Nitrate Leaching, Paddy

D3 **[21]**

EFFECT OF GENETIC (VARIETAL) DIVERSITY OF ROOTSTOCK ON THE GRAFTING SUCCESS OF MANGO (*Mangifera indica*)

P.G.A.S. Warnasooriya[1], W.A.P. Weerakkody[1] and P. Amarasekara[1]

[1]*Department of Crop Science, Faculty of Agriculture, University of Peradeniya, Sri Lanka*

ABSTRACT

Mango var. *Karthakolomban,* has reported incompatibility based yield retardation in commercial cultivations in Sri Lanka. Grafting is the widely practiced propagation method for mango. Therefore, the incompatibility could be caused by poor craftsmanship in grafting and or genetic variability of the plant materials. In this research the effect of genetic nature of stock plant material on grafting compatibility of the variety *Karthakolomban* was evaluated using morphological, anatomical and biochemical indicators. In this study, 6 month-old mango (*Mangifera indica*) var. *Kohuamba, Gira amba, Welleikolomban,* and *Wal amba* seedlings were grafted to var. *Karthakolomban* scion, (stock plant treatments). As for grafting success, measured in terms of survival rate at 45 days after grafting, *Gira amba* showed the highest, followed by *Kohuamba, Welleikolomban,* and *Wal amba* varieties. In the biochemical analysis, peroxidase activity (PA) at the graft union was determined at 2 and 6 months after grafting (MAG). At 2 MAG, *Gira amba* showed the highest PA, despite the fact that the difference was not significant. At 6 MAG, *Gira amba* and *Wal amba* indicated a significantly higher PA. Moreover, in general PA reported higher levels at 6 months than 2 month after grafting. Hence peroxidase activity at the graft union at 6 month after grafting could be used as a parameter for determination of genetic variability on grafting success.

Keywords: Grafting, Peroxidase Activity, Incompatibility

D4 **[22]**

EFFECT OF AGRONOMIC MANAGEMENT PRACTICES IN ENHANCING THE PERFORMANCE OF FLOODED-DIRECT SEEDED RICE IN SRI LANKA

T.K. Illangakoon[1], B. Marambe[2], R.S.K. Keerthisena[1], A.P. Bentota[1], S. Kulatunge[1], W.U.S. Geethika[1], V. Kumar[3] and A. Ismail[3]

[1] *Rice Research and Development Institute, Sri Lanka*

[2] *Faculty of Agriculture, University of Peradeniya, Sri Lanka*

[3]*International Rice Research Institute, Los Banos, Philippines*

ABSTRACT

Anaerobic germination tolerance (AG-tolerance) of rice is the ability of rice to germinate and develop seedlings under flooded (O_2 limited) condition. AG tolerance together with suitable management options can be utilized to have an optimum stand establishment under water logged condition and to suppress weeds in direct seeded rice (DSR). This study was designed to identify the effect of seeding rate (100, 80 and 60 kg/ha), flooding depth (saturated, 2.5 and 5 cm) and hydro-priming (24h pre-soaking & 48h incubation, 24h and 36h of hydro-priming) on stand establishment, weed growth and yield of rice sown under flooded condition. Trials were conducted using BG 366, BG 300, Ciherang AG1+Sub1 and IR 64+AG1 during 2015 and 2016 at Rice Research and Development Institute, Sri Lanka. Flooding reduced stand establishment, panicle density and yield of all varieties compared to saturated condition. Flooding depth of 2.5 cm had significantly higher stand establishment and weed density compared to 5 cm but both had statistically similar ($p<0.05$) panicle density and yield. Flooding depth of 5 cm reduced weed density by 6-folds and grasses by 96 % compared with saturated condition. The highest densities of seedlings and panicles and yield were recorded in 100 kg/ha of seeding rate under flooded conditions. Hydro-priming did not increase stand establishment compared with pre-soaking. Therefore, combination of 2.5-5 cm of flooding depth, 100kg/ha of seeding rate and pre-soaking can be used to optimize the stand establishment and to minimize the weed growth without much reduction in yield. However, need of novel AG-tolerance varieties capable of producing a satisfactory stand establishment and yield under flooded-DSR comparable to saturated condition is highlighted.

Keywords: Flooding, Priming, Seeding Rate, Water Depth

E1 **[23]**

LIVESTOCK FEED AVAILABILITY IN MANMUNAI SOUTH ERUVIL PATTU DIVISIONAL SECRETARIAT DIVISION IN BATTICALOA DISTRICT

M.M. Mahusoon

Eastern University, Sri Lanka

ABSTRACT

A study was conducted to determine the availability of feed and their distribution in the Manmunai South Eruvil Pattu Secretariat Division in Batticaloa district during the period of January 2017 to May 2017. The study covered 150 livestock producers from 12 villages which located in Kaluvanchikkudy Veterinary range. Data were analyzed using descriptive statistics. Aspects of socio economic of farmers, management practices, and feed information were collected. The study revealed that almost more than half of the farmers (66%) had experience more than 10 years that is sufficient for better management and care for more livestock production. Majority of the farmers were small holders (56%). Almost 42% of the respondents were practiced fully intensive rearing system while 39% were adopting tethering system for livestock farming. With regards to educational level, most of them were under primary level (48%) and another 7% of them were not even schooled. Rice straw, rice bran, tree fodders such as gliricidia and ipil ipil, kitchen waste, crop residues were major available feed in Manmunai South Eruvil pattu divisions. Paddy straw was available by 80% of the farmers meanwhile availability of rice bran and fodders were 54% and 20% respectively. Kitchen wastes were used by farmers regularly such as coconut scrap, vegetable waste, fish waste and meat waste.

Most of the farmers (82%) reported the major constraints in farm were high cost for concentrate feeds followed by low price for milk production, lack of grasses and grass land, lack of credit facilities and less adoption of improved management practices and lack of knowledge about integrated farming. Conducive climatic condition and paddy cultivation were the merit to the feed availability. Taking necessary remedies to uplift the technology involved in feed production, providing good veterinary support, expanding pasture and fodder production and educating farmers the merits of incorporating improved management practices would give a boost to livestock production

Keywords: Livestock Feed, Socio Economic Aspects, Constraints

E2 **[24]**

DAIRY FARMER'S INTEREST IN THE ACTIVITIES OF LIVESTOCK EXTENSIONS AT MALANG AREA, EAST JAVA, INDONESIA

A. Winaya[1], Sutawi[1] and T. Kurlyana[1]

[1]*Department of Animal Science, Faculty of Agriculture and Animal Science, University of Muhammadiyah Malang, Indonesia*

ABSTRACT

The farmer's extension is one effort that could encourage the farmer productivity in the raising of dairy cattle. The purpose of this research was to know the influence of age, education, farming experience and the number of livestock to the interest of dairy farmer in the farmer extension activity in Malang area, East Java. The research method was using survey method, and the primary data was collected by direct interviews that guided by questionnaires on dairy farmers in Batu City, Malang area. The data obtained from the respondents performed by the validity and reliability and then followed by analysis using multiple regression analysis with the classical assumption that was F-test, t-test, and coefficient of determination. The data normality test showed no abnormality data, so the data were suitable for analysis. The F test was significance ($p < 0.05$) and t-test was significance ($p<0.5$) on age (0.024) and education (0.003), but farming experience (0.618) and number of livestock (0.225) were not significant($p > 0.05$). The education of farmer has the highest coefficient determination value (35 %). The conclusions of this study that age, education, farming experience, and livestock ownership were significantly influenced ($p<0.05$) on the interest of dairy farmers in the extension activities in Batu City, Malang area and the age and education status of farmer were needed attention because it have significant effect.

Keywords: Batu City, Education, Extension, Dairy Farmer, Livestock

F1 **[25]**

DEVELOPMENT AND QUALITY EVALUATION OF COCOA INCORPORATED CASHEW NUT SPREAD

K.H.I. Gimhani[1], W.S.M. Senevirathne[1] and G.S.P. Fernando[2]

[1]*Department of Food Science and Technology, Sabaragamuwa University of Sri Lanka, Sri Lanka*

[2]*Department of Quality Assurance and Research and Development, Cargills Agrifoods Ltd, Sri Lanka*

ABSTRACT

Nut spreads are popular and widely accepted by the consumers due to their flavor, nutritional value and convenience. The objective of this study was to develop a nut spread using cashew nuts and the cocoa powder. Three formulations were developed using cashew butter, cocoa powder, sugar, water, vegetable oil, skimmed milk powder, whey powder, lecithin and carrageenan by changing the ratio of cashew butter to cocoa powder. Then they were evaluated for the sensory attributes of appearance, color, odor, spreadablity, taste, mouth feel and overall acceptability using a nine-point hedonic scale. Shelf-life of the most sensory scored formulation was tested for six weeks at different storage conditions. Then its crude protein, crude fat, moisture, total solids, ash and crude fiber content were analyzed. The study revealed that the cashew nut spread prepared with 8.5% cashew butter and 5% cocoa powder was most accepted. It contained 0.91% crude protein, 14.66% crude fat, 28.51% moisture, 71.49% total solids, 4.16% ash (dry basis) and 1.83% of crude fiber. There was a significant difference among the three tested nut spreads with respect to appearance, color and the mouth feel only. The best scored formulation could be stored best at refrigeration condition with minimum alteration of its microbiological, chemical and sensory qualities. Therefore, it could be concluded that cashew nuts can be successfully used for the production of a cocoa incorporated nut spread which would have a good market potential in Sri Lanka.

Keywords: Cashew Nut, Cocoa, Nut Spread

F2 **[26]**

PARADIGM SHIFT IN CROP RESIDUE MANAGEMENT IN ASIA

M.S. Pal

G B Pant University of Agriculture & Technology, India

ABSTRACT

Nearly 25-40% of crop residue is burnt producing not only harmful green house gases like C02, CO, N20, N0, CH4 etc. but also generates black carbon or soot in atmosphere extending up to 3 km high making atmosphere brownish haze or atmosphereic brown cloud (ABC) or smog. Presently the total approximate volume of crop residues produced in the world is approximately 4000 mt including 500 mt produced in USA, 510-520 mt in India, 900 mt in China, 120 mt in Indonesia, 70 mt in Pakistan, 60-65 mt in Bangladesh, 65 mt in Thailand, 55 mt in Vietnam, 5 mt in Sri Lanka and as a whole 1885 mt in Asia. In India, nearly 234 million tons/year (i.e. 30%) of gross residue is available as surplus (Devi et al, 2017) but MNRE (2009) quantified it equal to 140.89 mt contributed by 58% by cereals, 23% by fibre crops, 2% by each sugarcane and pulses, 7% by oilseeds and 8% by other crops. Crop residue is a primary source of plant nutrients containing average 0.8% N, 0.1% P and 1.3% K, so the NPK contained in crop residues produced is about 11-12mt in India and 81 mt in the world.

In India, it is estimated that 92.81 mt crop residues is brunt annually and National Capital region (NCR) comes under heavy environmental pollution during April-May and October-November months after wheat and rice residue burning, respectively in Punjab, Haryana and Western UP. The major cause of residue burning is unavailability of proper technology to manage it quickly so that farmers can make their field ready for subsequent crop sowing. Traditionally the crop residues is used as a live stock feed, bedding materials for animals compost and house hold burning but recently it is also used in vermicompost preparation, biogas generation, gasification and bio-energy production (ethanol), mushroom production and production of biochar. Besides, the crop residue is a good source of organic matter and mulching particularly in arid and semi arid region. Therefore the conservation agriculture along with collection and utilization of crop residues as a industrial raw material may solve the burning

Keywords: ABC, Biochar, Biogas, Burning, Crop Residue, Gasification, Smog

F3 **[27]**

EVALUATION OF CUTTING TYPE AND POT SIZE ON MASS PRODUCTION OF BETEL *(Piper betle)* PLANTS

T.G.B. Dhanushka[1], B.P. Siriwardane[1], N.P. Vidanapathirana[1], D.B.R. Swarnathilaka[2] and S.A.D. Thilakarathne[1]

[1]*Department of Agro Technology, Institute for Agro – technology and Rural Sciences, University of Colombo, Sri Lanka*

[2]*Tissue Culture Research Center, Department of Export Agriculture, Gampaha, Sri Lanka*

ABSTRACT

Betelis growing in Sri Lanka for both for local consumption and export market. Shortage of healthy and vigorous planting materials is a one of the major problems in betel. Maintenance of betel plants in nursery stage is important for uniform disease-free crop. This experiment was aimed to evaluate effectiveness two factors such as different cutting types and pot size for better betel propagation. Factorial Complete Randomized Design with ten replicates was used as experimental design. As factor 1, three cutting types were used. They were, cutting with apical bud, main stem cuttings and lateral branches cuttings. As Factor 2, l 8”x5” polythene bag, 6”x4” polythene bag and 6”x3” polythene bag were used. Girth of plant, height of plant, no of leaves, no of nodes, intermodal, dry weight of roots, wet weight of roots, dry weight of leaves, wet weight of leaves, dry weight of shoots, wet weight of shoots were used as parameters. Material cost and transporting cost were collected for the cost analysis. According to the findings, there is no significant effects from pot size and type of cutting on volume of roots, fresh and dry root weights, fresh shoot weight, inter node length, number of nodes and plant girth .Fresh weight of leaves, dry weight of leaves, mean height of plant and mean no of leaves are significantly affected by size of pot. The most efficient pot size is 6’x4’ and the cost effective post size is 6’x3’ pot size. Main stem cuttings and lateral cuttings can be effectively used instead of cuttings with apical buds.

Keywords: *Piper betel L.*, propagation, cutting type, pot size

G1 **[28]**

EFFECT OF MANURE PLUS AND INORGANIC FERTILIZER ON MAIZE PRODUCTION AND NUTRIENT UPTAKE OF STOVER

D.R. Lukiwati, F. Kusmiyati and B. Herwibawa

University of Diponegoro, Indonesia

ABSTRACT

Maize is used by farmer under crop-livestock integrated farming system (CLIFS) in Indonesia. The characteristic of CLIFS is crop yield for food, stover for feed, cattle dung for manure as organic fertilizer. The quality of manure could be increased by adding organic phosphorus (guano, rock phosphate/RP) at initial phase of decomposition process. This research was aimed to improve manure quality by adding organic phosphorus that was called as manure plus, then to evaluate manure plus and inorganic fertilizer on maize production, dry matter production and nutrient uptake of stover. Chemical properties of manure plus and nutrient of stover were evaluated at the laboratory and field experiment with 6 treatments of fertilization and five replicates at latosolic soil. The treatments were TSP+ZA+KCl, manure+(TSP+ZA+KCl), manure+(RP+ZA+KCl), manure+(guano+ZA+KCl), (manure+RP)+(ZA+KCl), and (manure+guano)+ZA+KCl. The maize was harvested at 11 weeks after planting. Parameter measured were maize production, dry matter production and nutrient uptake of stover. The result showed that the chemical properties of manure plus was varied. Manure+RP was higher in P (3.26%) and K (3.10%) compared to manure and manure+guano. Manure+guano was higher in N (1.66%) compared to manure and manure+RP. However, the effect of all the treatment was no significantly different on maize production, dry matter production and nutrient uptake of stover, except on N uptake of stover. It was concluded that manure plus replaces TSP as inorganic fertilizer.

Keywords: Dry matter, guano, manure, nutrient, rock phosphate, sticky maize

G2 **[29]**

EFFECTS OF DIFFERENT COMPOST LEVELS ON GROWTH AND YIELD PERFORMANCE OF FINGER MILLET (*Eleusine coracana* L.) UNDER DL5 AGRO-ECOLOGICAL ZONE OF SRI LANKA

S.K.H.K. Rasika[1], D.P.P. Liyanage[2] and S.D. Wanniarachchi[3]

[1] *Institute for Agro Technology and Rural Sciences, University of Colombo, Sri Lanka*

[2] *Grain Legume and Oil Crops Research and Development Center, Department of Agriculture, Angunakonapelassa, Sri Lanka*

[3]*Department of Soil Science, Faculty of Agriculture, University of Ruhuna, Sri Lanka*

ABSTRACT

Finger Millet (Kurakkan) is a native plant to Africa and is a popular crop in the tropics due to its high nutritional value. Finger millet is a continuously grown crop in low country dry zone under rain-fed system in Sri Lanka, generally cultivated without using organic or inorganic fertilizers. As a crop belongs to family poaceae, it is not able to fix atmospheric N. The regular depletion of nutrition status of land and the degradation of soil properties due to continuous cultivation in same lands without proper land preparation have resulted in decreasing productivity of finger millet and compacted soil structure with the time. This study was carried out to determine the effects of compost on growth and yield performance of finger millet under the rain-fed farming systems during the 2015/16 Maha and 2016Yala seasons at the Institute for Agro Technology and Rural Sciences of the University of Colombo in Weligatta. Different compost levels (1MT/ha, 2MT/ha, 3MT/ha, 4MT/ha, 5MT/ha and 6MT/ha) were tested as treatments in a Randomized Complete Block Design with 4 replicates and 3 MT/ha treatment was used as the control and the plot size was 9 m^2. Regular application of compost on soilled to enhancement of the number of leaves, number of tillers, plant height and yield of finger millet while decreasing number of days to flowering. Grain and Stover N and K of finger millet were enhanced with the application of compost and the variation of grain and stover P did not show a clear trend as N and K.

Keywords: Finger Millet, rain-fed system, yield, growth, compost

G3 **[30]**

EFFECT OF ORGANIC FERTILIZATION ON GROWTH, YIELD AND QUALITY AND QUALITY OF PEAS *Pisum sativum* L.

M.A. Sultan

Mosul University, Republic of Iraq

ABSTRACT

The experiment was carried out at the field of vegetable crops / College of Agriculture and Forestry / University of Mosul during spring season 2013 and fall season 2013/2014 to study the effect of spraying with different concentrations of seaweed extract kelp 40,Zero.1 and 2ml/L the first one at 3-5 true leaf stage , the second after two weeks from the first one , on four pea cultivars . Results showed that cv. Little Marvel gave the highest values in plant height 40.26 cm in the spring season as compared with 53.34spad value in fall season . Concerning the fertilizer the results revealed that seaweed extract kelp 40 at 1ml/L gave the highest value in plant height 24.29cm. In fall season , this treatment also gave the highest vale in chlorophyll 24.89spad value in spring season . The treatment 2ml/L gave the highest value 61.91 for pods/plant in fall season. I'm general results of fall season was superior than spring season for most of the studied traits .

Keywords: Organic Pea , fertilization , cultivar , spraying , agriculture

G4 **[31]**

PRODUCTIVITY AND ECONOMICS OF MAIZE BASED CROPPING SYSTEMS UNDER ORGANIC PRODUCTION SYSTEM IN INDIA

S.K. Sharma[1], R. Choudhary[1] and G. Jat[1]

[1]*Organic Farming Unit, Directorate of Research, Maharana Pratap University of Agriculture & Technology, India*

ABSTRACT

Organic farming is becoming popular in India. About 2.7 million farmers in India are practicing organic farming. Maize is the 5th major crop of India. Many maize based cropping systems are being practiced in India with different management practices. Productivity & profitability of different maize based cropping system is greatly influenced under organic & inorganic production system. Four maize based cropping systems: maize + blackgram (2:2) - durum wheat–sesbania (GM); sweet corn + blackgram (2:2) – chickpea;blackgram – wheat and soybean – fenugreek and six nutrient management practices (100% organic management, 75% organic + innovative practices, 50% Organic + 50% inorganic, 75% organic + 25% inorganic, 100% inorganic management and state recommendation were evaluated during 2015-16 and 2016-17 at Agronomy Farm of Rajasthan College of Agriculture, Udaipur (Rajasthan), India.. The soil of experimental field was clay loam in texture with bulk density 1.24 g/cc, pH 8.1 and organic carbon 0.86 per cent. The soil containing available N (223.42 kg/ha) and P_2O_5 (30.96 kg/ha) and available K_2O (262.25 kg/ha).Among the different cropping systems, maize + black gram-durum wheat cropping system gave maximum maize equivalent yield (10150 kg/ha) followed by black gram-bread wheat cropping systems (7538 kg/ha). In terms of profitability sweet corn + blackgram- chickpea cropping system recorded maximum net return (Rs183069/ha) under state recommendations practice followed by 100% inorganic practice (Rs159802/ha) in maize + blackgram-durum wheat cropping systems. Among the different nutrient management practices, application of 100% inorganic practices recorded maximum maize equivalent yield (7059 kg/ha) followed by 50% organic + 50% inorganic practices (6925kg/ha).

Keywords: Maize Based Cropping System, management practices, organic production

H1 **[32]**

IMPACT OF THE BASAL DRESSING FOR SEEDLING STAGE OF GREEN GRAM (*Vigna radiate* L.)

S.L. Nawarathna[1], H.K.A. Nishantha[1] and D.D.P. Arunasiri[1]

[1]*Department of Agro-technology, Institute for Agro-technology and Rural Sciences, University of Colombo, Sri Lanka*

ABSTRACT

Many of farmer use inorganic fertilizer as a basal when cultivate the green gram with aim of high yield but it affect direct and indirectly to the soil fertility and living organisms for long period. Its increase the cost of production per Acer and it produced environmental pollution. But there is no effort has taken to reduce the use of basal dressing of inorganic fertilizer in green gram cultivation. Meanwhile farmers have to face less germination of green grams due to unsuitable soil surface and hard porosity due to the poor management of soil. As a solution farmers tend to apply organic manure for their field with the positive impact to the environment. Therefore this study is focus on suitable organic basal dressing for the seedling stage of green gram. Three organic fertilizers (compost, vermicompost and bio-char) and recommended inorganic basal (Urea, MOP and TSP) used as treatments. The following parameters were analyzed such as germination percentage, seedling length, fresh weight, dry weight, root length and root volume of seedlings. As the result of this study that it was not significantly affect on germination of green gram in between organic and inorganic applications. Seedling length, fresh weight, root length and root volume of seedlings were increased significantly in vermicompost and bio char applied medium compared to the other organic and inorganic fertilizers. According to findings this study concluded that vermicompost and bio char can be recommended as basal dressing for the green gram (*Vigna radiata* L.) production.

Keywords: Basal Dressing, vermicompost, Bio-Char, inorganic fertilizer, *Vigna radiata* L.

H2 **[33]**

LAND-USE CHANGE EFFECTS ON THE PHYSICAL QUALITY OF PHILIPPINE UPLAND TROPICAL SOIL

R.M. Monteza[1] and W.M. Cornelis[2]

[1]*College of Agriculture and Environmental Sciences, Southern Leyte State University, Philippines*

[2]*Department of Soil Management, Ghent University, Belgium*

ABSTRACT

Conversion of land is a widespread phenomenon not only in temperate but most especially in the tropics. In the Philippines, land use change is believed to be one of the cause of land degradation. In order to conserve the environment and sustain the demands of increasing agricultural land, a good soil quality is needed. The study evaluated the effect of land-use change on the physical quality of upland tropical soil using 8 indicators. Five land uses were examined including Mahogany plantation, Coffee Plantation, Grassland, Rainforestation site, and Secondary forest. One hundred soil core samples were collected from five land uses at varying depths from 0-40cm. Statistical analysis showed significant difference in bulk density, total porosity, soil macroporosity (MacPor), aggregate and structural index, and field saturated hydraulic conductivity (Kfs). Parameters derived from the water retention curve showed statistical difference at 20-40cm soil depth and includes moisture content at field capacity (-340cm), moisture content at permanent wilting point, air capacity and soil water storage capacity for both pressure heads of -100cm and -340cm, and plant available water capacity (-100cm). The field evaluation of the soil structure by Visual Evaluation of Soil Structure (VESS) showed a significant difference as well. The soil physical quality index (SPQI) calculation showed that the conversion of secondary forest to other land uses resulted to a higher SPQ scores of >80%. However, among the five land uses Mahogany plantation has the most improved soil physical quality with an SPQI score of 0.88.

Keywords: Soil Physical Quality Index (SPQI), tropical soils, land conversion, land degradation, VESS

H3 **[34]**

EXOGENOUS NITRIC OXIDE DONOR SODIUM NITROPRUSSIDE IMPROVES GROWTH AND PHYSIOLOGICAL ATTRIBUTES OF RUBBER (*Hevea brasiliensis*) UNDER ABIOTIC STRESS CONDITIONS

N.M.C. Nayanakantha[1], B.M.S.S. Panditharatne[1], S.A. Nakandala[1], W. Karunathilake[1] and P. Seneviratne[1]

[1]*Plant Science Department, Rubber Research Institute of Sri Lanka, Dartonfield, Agalawatta, Sri Lanka*

ABSTRACT

Cultivation of rubber (*Hevea brasiliensis* Muell Arg.*)* is being extended to non–traditional areas of Sri Lanka where extreme climatic conditions like drought and heat are the major impediments limiting the crop performance. Nitric oxide (NO) is a signaling molecule which has proved to be protective against damages provoked by abiotic stresses. Here, we studied the effect of NO donor sodium nitroprusside (SNP) at 50 &100µM concentrations on the response of *Hevea* clone PB 260 subjected to drought stress in a glass house (Dartonfield, Agalawatta). Photosynthesis rate (*Pr*), stomatal conductance (*gs*) and chlorophyll content (*Cc*) were recorded at 0, 2, 4, 7 and 14 day's intervals and two weeks after the treatments. Field grown plants (Nottinghill private estate, Mawathagama, Intermediate Zone) of *Hevea* clone RRISL 203 were imposed with SNP at 100, 150 and 200 µM concentrations at monthly intervals for a period of six months. Girth and physiological attributes *viz., Pr, gs, Cc,* leaf water potential (Ψ) were recorded before and after the treatments at different time intervals, up to one year. Soil moisture content and weather data were also recorded. Significantly higher *Pr* and *Cc* were recorded in drought imposed plants treated with SNP as compared to control (devoid of SNP treatment) in the glass house. Girth and physiological attributes *viz., Pr, Cc and* Ψ of the field grown plants imposed with SNP increased significantly as compared to control. Therefore, exogenous SNP proved to be beneficial in improving growth and physiological attributes of *Hevea* under abiotic stress conditions.

Keywords: Abiotic Stress, Growth, Physiological Attributes, Rubber, Sodium Nitroprusside

H4 **[35]**

SAFE AND HEALTHY FARMING COMMUNITY: INTERVENTIONS FOR ALLEVIATING HAZARDS IN AGRICULTURE

V. Rekha

Maharana Pratap University of Agriculture and Technology Udaipur (Raj.), India

ABSTRACT

Agriculture sector in India has experienced phenomenal change and has made a significant contribution in ensuring food security to the growing population. It was not possible without the use of conventional agronomical practices. Thus, increased use of farm machinery and agricultural inputs has been the cause of threat not only to the environment but also to the human health. A research was conducted for assessing the hazards and providing education and informal training to the farming community on health hazards and safety while work. An intervention package based on ergonomics was developed which highlighted the health and safety practices to be adopted by the farm workers with the assumption that simple ergonomic solutions can positively improve the quality of life of farming community.

The data obtained revealed that Mean Percent Score of the respondents for physiological hazard was approximately 60 per cent for males who experienced it during sowing, plant protection, harvesting and threshing whereas nearly 70 per cent of females reported this hazard during sowing, harvesting, weeding and threshing activity. The MPS of the respondents for mechanical hazards for weeding was 80-90 per cent for all the farm workers. Male farm workers were directly involved in the activities of plant protection and thus were more prone to chemical hazards. The prominent environmental hazards identified included fatal poisonous bites and stings, cold, sunburn and allergies. More females than males confronted various hazards in all the agricultural activities. There was major gain in knowledge of the respondents after exposure to intervention package. The average posttest knowledge gain score was 58.5 for males, with a percentage increase of 64 over pretest scores. For females the posttest knowledge gain score was 55, with a 78 percent increase in knowledge over pretest scores. This confirms that the educational interventions can be effective in creating awareness and learning to lead a safe and healthy life.

Keywords: Ergonomics, Hazards, Educational Interventions, Agricultural Workers

H5 **[36]**

MODIFIED ALLEY CROPPING AS A CLIMATE ADAPTIVE SYSTEM TO IMPROVE THE PRODUCTIVITY OF IRRIGATED UPLANDS

M.S. Nijamudeen[1], R.A.C.J. Perera[1], M.A.P.W.K. Malaviarachchi[1] and K.A. Renuka[1]

[1]*Field Crops Research and Development Institute, Mahailluppallama, Sri Lanka*

ABRSTRACT

Alley cropping is a production system where food crops are grown in between hedgerows formed by leguminous trees. Alley cropping retains the basic restorative attributes of the bush fallow through nutrient recycling, fertility regeneration and weeds suppression and combines these with arable cropping. However, adaptability of alley cropping technology to rain-fed upland cropping systems in the Dry zone is poor mainly due to the technical and economical difficulties of subsistence farming. Therefore the experiment was aimed to study the land productivity of modified alley cropping system incorporating sprinkler irrigation and widening the alley rows. An experiment was conducted at the Field Crops Research and Development Institute, Mahailluppallama. Giliricidia (*Giliricidia sepium*) was used as the alley hedge rows. Green gram and cowpea crops were cultivated in existing alley crop field. Six treatments namely; rain fed condition with non-alley, sprinkler irrigated with non-alley, rain fed with alley lopping, rain fed with alley non-lopping, sprinkler irrigated with alley lopping and sprinkler irrigated with alley non-lopping were established. Result revealed that the seed yield of green gram and cowpea increased around 45% with alley cropping system included sprinkler and lopping compare to the non alley sprinkler. It was found to be the average temperature of 1.5 and 1 °C can be reduced during cropping period in yala and maha season, respectively. Hence the modified alley cropping system can be adopted to improve the productivity with the climate change scenario.

Keywords: Modified Alley Cropping, Sprinkler Irrigation, Climate Change

H6 **[37]**

CONSERVATION OF THREATEN SPECIES IN THE NORTHERN PROVINCE OF SRI LANKA: BIODIVERSITY, ADAPTATION, FOOD SECURITY AND LIVELIHOODS

K. Jeyavanan[1], S. Sivachandran[1], T. Sivananthawerl[2] and D.K.N.G. Pushpakumara[2]

[1]*Department of Agronomy, Faculty of Agriculture, University of Jaffna, Sri Lanka*

[2]*Department of Crop Science, Faculty of Agriculture, University of Peradeniya, Sri Lanka*

ABSTRACT

Sri Lanka riches in biological diversity and endemism identified as one of the top 34 biological hotspots in the world. Biodiversity is getting eroded in a rapid pace at present and it is well recognized that the current loss of biodiversity is a result of both direct and indirect influences, such as habitat loss and fragmentation, deforestation, encroachment, excess use of agro-chemicals, climate change impacts and resettlements. On identifying the gravity and the importance of this issue, the biodiversity secretariat of the Ministry has taken steps to conserve threatened plant and animal species through *In-situ* and *Ex-situ* conservation as per the biodiversity conservation action plan and the updated red data list of threatened fauna and flora in Sri Lanka. From the literatures, it can be seen that scientific research made on threatened species was mostly related to pharmacological activity in elsewhere of the country. However, in Northern Province of Sri Lanka, there is less evidence on its distribution, species, crop phenology and other phenotypic characters. The aim of the study is to identify the threatened species in the Northern Province of Sri Lanka options for biodiversity, adaptation, food security and livelihood. The study was carried out in homegardens of Jaffna district and, reserve and plantations forest of Mullaitivu district in Sri Lanka. Result of the study revealed that there were most significant and threaten species recorded in both homegarden's and reserved forest's in the Northern Region of Sri Lanka and these were identified as least concerned (LC), near threatened (NT), vulnerable (VU), endangered (ET) and critically endangered (CR). Among them, some trees were also recorded as highly medicinal important and rarely distributed in these areas. Hence, it is urgently needed to conserve these threaten species through scientific studies, public private partnership, conservation and management of critical habitats, policy/legal and institutional support, environmental education and awareness in the Northern Regions of Sri Lanka.

Keywords: Conservation, Red Listed Species, Northern Province, Sri Lanka

H7 **[38]**

ZONATION OF SOIL EROSION HAZARD TO IMPLEMENT SOIL CONSERVATION PRACTICES AT AGRICULTURAL LANDS IN SRI LANKA: A CASE STUDY IN SABARAGAMUWA PROVINCE

S.S. Senanayake

Natural Resources Management Center ,Peradeniya, Sri Lanka

ABSTRACT

Soil erosion by the water is a great threat for the agriculture in Sri Lanka. Recent development of infrastructure facilities and other industrial sector, lots of agricultural lands (arable lands) have been neglected. The climate variation: warming temperature and increased frequency of extreme events, flooding and drought are inducing this situation. This paper is focused on the use of Geo-informatics techniques to identifying and prioritizing vulnerable areas for soil conservation in Kagalle and Ratnapura district in Sabaragamuwa Province, with prognosis and observe dynamism of soil erosion hazard by revised Universal Soil loss equation method (RUSLE) to present climate variation. Geo-informatics is a useful technology for identifying and prioritizing areas for soil and water conservation which are critical to restoring and protecting for crop production. Multisource datasets were obtained for static and dynamic factors of RUSLE and an integrated analysis was carried in raster format. The NBRO hazard zonation maps and field observations were used to validate soil erosion intensities of the study area. The soil erosion hazard map clearly shows that nearly 61% (3012 km2) of total area of the province is highly vulnerable for soil erosion. Nine micro-watersheds of six major rivers were delineated based on drainage systems. The 2 out of 9 micro-water sheds fell under Kaleni River basin produce high intensity of soil erosion. Prognosis analysis on soil erosion hazard helps decision makers to develop proper conservation plan to the province and field level officers to install on farm and off farm conservation structures in sustainable manner.

Keywords: Erosion Hazard, Agricultural Land, Geo-informatics

H8 **[39]**

EVALUATION OF DIFFERENT CLIMATE CHANGE- ADAPTIVE PACKAGES OF PRACTICES ON ECOFRIENDLY CHILLI (*Capsicum frutescens* L.) PRODUCTION IN DRY ZONE OF SRI LANKA

G. Asharp[1] and S. Sivachandiran[1]

[1]*Department of Agronomy, Faculty of Agriculture, University of Jaffna, Sri Lanka*

ABSTRACT

A field experiment was conducted at integrated farm and training center, Faculty of Agriculture, University of Jaffna, Kanagarayankulam, during February to July 2017, to evaluate the impact of different shade levels, effect of different weeding intervals and importance of border crop on growth and yield performance of Chilli. The treatments consisted of three shade levels (shade level one, two and no shade) and four weeding intervals (weeding at one week, two week, three week intervals and no weeding) with and without the border crop in split plot arrangement with three replicates. Light intensity and relative humidity were statistically significant ($p<0.05$) among shade levels. Weed density and weed dry matter were significantly differed with different weeding intervals. Survival rate was peaked at shade level one. Disease incidence was significantly influenced by both shade treatment and weeding interval treatments with and without border crop. The lowest disease incidence was recorded as 14.04% within the border crop experimental site. Different shade treatments and different weeding interval treatments with and without border crop have shown significant ($p<0.05$) effect on plant height, number of leaves, leaf length, fruit length and total yields. Shade level one and weeding at one week interval with border crop have shown significantly ($p<0.05$) higher growth and yield performance compared to the other levels of treatment. Hence these results could be used successfully in farmer's field to minimize the effect of adverse climatic condition and use of excess agro chemicals on growth and yield of chilli.

Keywords: Climatic Conditions, Chilli, Dry Zone, Farmers, Weeding Interval

H9 **[40]**

AGRONOMIC PERFORMANCES IN M_1 GENERATION OF AROMATIC AND NON-AROMATIC RICE CULTIVARS UNDER DROUGHT STRESS LEVEL OF –0.03 MPa

B. Herwibawa[1], Sakhidin[2] and T.A.D. Haryanto[2]

[1] *Laboratory of Physiology and Crop Breeding, Faculty of Animal and Agricultural Sciences, Diponegoro University, Tembalang Campus, Indonesia*

[2] *Laboratory of Plant Breeding and Biotechnology, Faculty of Agriculture, Jenderal Soedirman University, Karangwangkal Campus, Indonesia*

ABSTRACT

The greenhouse gas emissions increases along with the development of flooded rice fields, so the efforts to improve the drought-resistance characters on rice is viewed as one of environmentally friendly solutions that can give significant contribution to control the global warming. The research was arranged in split-plot design with ten replications. There were four rice cultivars as the main plot and nine mutagen groups as the sub-plot, so there were 36 treatment combinations. The observation was based on data of agronomic performances. The data were tabulated and analyzed with generalized linear models in PROC GLIMMIX procedure of SAS 9.4 software. Least square means were generated and compared through ADJUST=SIMULATE LINES option of LSMEANS statements, and the significance level for tests of significance among means was set at probability level of 0.05. The result showed that the genotypes in M_1 generation shows high diversity under the drought stress level of -0.03 MPa, in which the best combination between cultivar and mutagen is Inpago Unsoed 1 that was irradiated with gamma 100 gray and then soaked in sodium azide for 2 hours. The results is expected to be used in determining the genotypes for the next drought-resistant rice breeding program.

Keywords: Diversity, Drought-Resistance, Mutation

H10 **[41]**

TESTING ADAPTABILITY AND SELECTION OF DROUGHT TOLERANT CIMMYT MAIZE HYBRIDS IN SRI LANKA

W.M.R. Kumari[1], D.C.S.M.I. Wijewardhana[1], N.A.P.S.G. Upasantha[1], W.M.N.D. Gunathilake[2], T. Karunainathan[3], W.M.W. Weerakoon[4] and B.S.Vivek[5]

[1] Field Crops Research and Development Institute, Mahailluppallama, Department of Agriculture, Sri Lanka

[2] Grain Legumes and Oil Crops Research and Development Institute, Agunakolapalasse, Sri Lanka

[3] Agriculture Research Station, Thirunevelli, Sri Lanka

[4] Department of Agriculture, Sri Lanka

[5] CIMMYT, India

ABSTRACT

Deploying of CIMMYT maize hybrids in Sri Lanka resulted high yielding, enhanced nutritional quality and drought tolerant maize hybrids to local farmers. Three maize hybrids, developed from CIMMYT inbred lines, "CML20/CML348", "CML161/CML194" and "CML451/CML286" were officially released by Department of Agriculture, Sri Lanka. Maize is second important cereal which is mainly grown as rainfed upland cereal in dry zone of Sri Lanka. Hence introducing drought tolerant maize hybrids is vital to maize cropping system where unexpected intermittent drought is experienced in rainy season. Testing adaptability and stability of CIMMYT drought tolerant nursery with 86 single cross hybrids were done in 2015. Subsequently, twelve promising hybrids were selected and evaluated in 2016. Then five most adaptable hybrids were selected and evaluated in 2017 and 2018 in multi-locational trials. The location mean yields were ranked based on Duncan mean separation and average ranks over location were used to select most adaptable hybrids. Stability parameter (S^2) derived from variance component methods was used to select stable hybrids. VH12926, VH12264 and VH12263 were finally selected as most adaptable and stable hybrids with desirable ear characters. These hybrids recorded average yield range from 5.42 to 6.58t/ha in trials conducted in research fields and farmers' fields under supplementary irrigation during 2017 and 2018. Whereas, popular exotic maize hybrid (check) recorded average yield of 7.2t/ha. The selected hybrids showed 105 – 115 days to harvest, 2 - 4 days of anthesis silking interval, ears with better grain filling up to tip of ear and acceptable ear characteristics by maize farmers.

Keywords: Maize Hybrids, Adaptability, Yield

H11 **[42]**

CROP WATER PRODUCTIVITY OF RICE UNDER SUSTAINED DEFICIT IRRIGATION

S.N.C.M. Dias[1], N. Schuetze[1], F. Lennartz[2], R.S.K. Keerthisena[3], D.M.K.K. Dissanayake[3]

[1]Institute of Hydrology and Meteorology, Dresden University of Technology, Germany

[2]Department of Arid land Agriculture, College of Food and Agriculture, United Arab Emirates University, UAE

[3]Department of Agriculture, Peradeniya, Sri Lanka

ABSTRACT

Deficit irrigation aims at stabilizing yields and at obtaining maximum water productivity rather than maximum yields. The response to water deficit depends on the pattern of stress imposed. In Sustained Deficit Irrigation (SDI), water deficit increases progressively as the season advances due to a combination of the uniform application of a reduced amount and the depletion of the soil water reserve. In Regulated Deficit Irrigation (RDI), the proportion of ETc given to plants during the growing season is altered, causing severe drought stress during a specific phenological stage.

With the aim of evaluating crop yield and water productivity of rice under SDI, a field experiment was conducted in Rice Research and Development Institute of Sri Lanka during minor cropping season (Yala), 2013 from March to September. Soil matric potential based irrigation was used, and treatments were laid out in a RCBD with four different levels and three replicates. Irrigation treatments were ranging from 0-40 mbar, 40-80 mbar, 80-120 mbar and 120-160 mbar.

Field experimental results show that soil matric potential threshold between 40-80 mbar is optimum in terms of maximizing yield (6.6 t/ha) and water productivity (1.1 kg/m3) under SDI. Therefore, even without practicing soil matric potential based irrigation, farmers can gain a better yield compared to the flooded rice production.

SDI allows for water stress to develop slowly and for the plants to adapt to the water deficits. Though dry matter partitioning is usually not affected, there could be direct effects on the HI as the water stress increases in severity.

Keywords: Rice, sustained deficit irrigation, water productivity, soil matric potential

H12 **[07]**

ANDROID-BASED HOME GARDENING COMPANION

R.A. Ruwanpathirana[1] and R.G.N. Meegama[1]

1Apple Research and Development Centre, Department of Computer Science, Faculty of Applied Sciences, University of Sri Jayewardenepura, Sri Lanka

ABSTRACT

This is a hybrid mobile application which will be useful for everyone who wishes to plant a garden in their home. It is targeted for people who live in urban areas where they can provide soil and other physical settings manually. It is a virtual assistant that will help and encourage the user to successfully plant and yield from a garden. First it will help the user to pick the best crop that is suitable to plant by visualizing the Google maps according to climatic factors such as temperature, humidity and pressure. They will also be used for predict and warn user about the future weather changes like rainfall. User will be accompanied by various types of information about the plant he selected for the rest of the time. He can track the progress of the selected plant and manually change it. After a major stage of development of the plant, user will be announced about it. Photos of the plant can be uploaded to the app and this would be like a timeline of the entire life span of the plant. This is an app that motivates people and help make habits of making successful gardens in urban areas.

Keywords: Home gardening, virtual assistant, mobile technologies

J1 **[43]**

AGRO - FORESTRY EXPANSION IN MIDDLE GANGETIC BASIN: ADOPTERS' MOTIVATIONS AND EXPERIENCES IN BIHAR, INDIA

R. Tiwary[1], D.M. Diwakar[1] and S. Mahapatro[1]

[1]*A.N. Sinha Institute of Social Studies, India*

ABSTRACT

Agro-forestry offers huge opportunities for sustainable agriculture in state of Bihar - a key agrarian state of Eastern India. Despite favourable agro-climatic, soil & drainage conditions, Bihar is identified with traditional and stagnant agriculture, low productivity, recurrent floods and droughts, rural poverty and lack of agro- industrial development. Government of Bihar has initiated special program for expansion of agro-forestry with an aim to raise income level of farmers, make available raw material for wood based industries and increase green cover in the state. The paper is based on evaluation study of implementation of the major agro- forestry schemes. Understanding adoption patterns, identification of key motives for practising agro forestry, experiences of farmers as well as analysing the barriers in expansion constituted the major themes of the research study. This paper is based on primary data sources (large scale beneficiary household survey based on Probability Proportionate to Size method), interviews, FGDs among beneficiary & non beneficiary communities, multi stakeholder meetings, field visits as well as secondary sources (reports, vision documents, etc).The paper analyses socio- economic background of farmers, adoption patterns (choice of plants, methods of plantation, survival and others), motivation behind adoption, comparative benefits of agro-forestry (*vis-a-vis* traditional agriculture) and farmers' experiences with government agro-forestry programs & promotional campaigns (in terms of awareness, ease of access, knowhow and others). Non beneficiaries but potential adopters were also interviewed to understand barriers of adoption. Paper provides policy recommendations and strategies for effective expansion of agro- forestry to achieve sustainable agriculture in the region.

Keywords: Agro-Forestry Adoption, Farmers' Motivations & Experiences, Expansion Strategies

J2 **[44]**

ANALYSIS OF WATER BALANCE TO DETERMINE CROPPING PATTERNS OF FOOD CROP IN WATERSHED TENGGARONG- KUTAI KARTANEGARA REGENCY

A.P. Sujalu[1] and A. Fatah[1]

[1]*Faculty of Agriculture, The University of 17th August 1945 Samarinda, Indonesia*

ABSTRACT

Growing periods can be determined using water balance analysis to decrease harvest risk in certain area, therefore, to develop a sustainable food crop, the water balance analysis is absolutely necessary. Generally, there are two types of land use for food crop i.e. irrigated land and non-irrigated land. The objective of experiment was to determine appropriate croping patterns of food crop in Watershed Tenggarong. The geographical position of the experiment site was between 116°49' EL–116°57' EL and 0°24' SL-0°28' SL, which cover 315.5 km^2. The data used were series of climate data for 37-years period (1978-2015). The high rainfall depth period was at December and April, therefore the low rainfall depth was at September and November. The calculation of land water balance according to Thornthwaite and Mather book keeping procedure (1957) is employed to determine the agroclimate condition to plan a general cropping patterns was used based on monthly data. The planting time period is the water holding capacity >50% from available water. Water Balance monthly indicated that this area have potential growing season about 9 months, water surplus 8 months (439.6 mm year^{-1}) and water deficits about 3 months (59.7 mm year^{-1}). In these area, rice could be planted twice a year without irrigation.

Keywords: Agroclimate, Water Balanced, Growing Season, Cropping Patterns, Rainfall, Watershed

J3 **[45]**

FARMERS' PERCEPTION AND ATTITUDE TOWARDS AQUASILVICULTURE IN THE ECOLOGICAL CRITICAL AREAS OF THE SUNDARBANS FOREST OF BANGLADESH

A. Sharmin[1], M. Hossain[1] and A.S. Mollick[1]

[1]*Forestry and Wood Technology Discipline, Khulna University, Bangladesh*

ABSTRACT

Aquasilviculture is one of the profitable agroforestry systems and now it is acceptable in many countries of the world. In Bangladesh, there are seven separate wetland areas which are declared as Ecological Critical Areas. Outside of the Sundarbans Reserved Forest at 10 km extent was also included as Ecological Critical Area (ECA). The livelihoods of a large number of farmers are now associated with fish farming in this region. Now a days, trees are planted on the dyke of the fish ponds in that area as aquasilviculture is very much effective technology where land is degraded and fertility is decreased due to saltiness of water. Aquasilviculture practice is seen as a good alternative and supplementary source of income to the poor farmers as it produce fish and simultaneously creates a new green cover. Present study intends to provide information regarding the status, benefits, problems of aquasilviculture and the farmers' perception and attitude towards the practice in the Ecological critical areas of the Sundarbans. The ECA area of Shyamnagarupazilla (Southwestern part of the Bangladesh)area was sub-divided into three zone i.e. zone 1: 0 to 1 km, zone 2: 4 to 5 km and zone 3: 9 to 10 km from the Sundarban. A representative number (about 5 to 10%) of shrimp farms were selected randomly from each zone and were interviewed through a semi-structured questionnaire. Both fresh water and salt water fishes were practiced in the study area and trees were planted on the dyke of both types of fish ponds. But some barren dykes are also present there. The majority of the farmers (87%) had positive attitude and clear perception about aquasilviculture practice. The farmers also perceived that trees helped them to increase income and provide sources of fuelwood, timber and fodder for their livestock. The respondents mainly preferred *Albizia procera, Acacia nilotica, Azadirachta indica, Psidium guava, Excoecaria agallocha* and *Avicennia officinalis* to plant on the dyke of the fish ponds. Farmers viewed that increased level of salinity in water and soils, unavailability of capital, inadequate technical assistance were the main hindrance to practice aquasilviculture in that region. Aquasilviculture practice could be a climate-smart and environmental friendly aquaculture practice in the area through increasing the green coverage and at the same time for the betterment of the livelihood of the local poor.

Keywords: Aquasilviculture, Ecological Critical Areas, Farmers' Perception, Attitude

J4 **[46]**

SYSTEM OF RICE INTENSIFICATION (SRI) MAINTAINS WATER-USE EFFICIENCY AND SOIL MICROBIAL BIOMASS IN RICE PADDY SYSTEM: A REVIEW IN ASIA

R. Supriyanto

School of Natural and Environmental Science, Newcastle University, UK

ABSTRACT

System of Rice Intensification (SRI) has been adopted widely around the world in order to improve sustainability and productivity of rice paddy system. Nonetheless, adoption of SRI by the rice growers has been varied due to concerns about labor issue, weed management, and local-climate adaptation that may hamper rice production system especially in Asia region. This paper compiled the results from peer-reviewed research articles comparing various SRI applications in Asia. The proponents consider SRI application can benefit to the adopters through (1) better water use efficiency up to 70%, (2) increase in rice yield by an average of 48% if combination of proper ecological practices was introduced, (3) practicality in pest management and control, (4) increase in microbial biomass and reduction in fertilizer use. On the other hand, major concerns faced by growers such as: labor issue which there was no clear evidence relating labor requirement to farm economic loss, and incapability of SRI to be adopted in drought-site area. This finding suggests that SRI can benefit the growers farming in water constrained area, while also wanting to improve soil quality. Proposing modification of SRI with site-specific may also minimize the impacts on yields.

Keywords: SRI, Water Use Efficiency, Soil Microbial Biomass, Agriculture Development, Sustainable Intensification, Rice Paddy

VIRTUAL PRESENTATIONS

[47]

CAN FOLIAR SPRAY OF BENZOIC ACIDS ENHANCE FORAGING BEHAVIOR OF POLLINATORS?

K. Hassan[1], N. Akter[1], Md.F. Mondal[1] and M. Pervin[2]

[1]Department of Entomology, Faculty of Agriculture, Sylhet Agriculture University, Bangladesh

[2]Faculty of Agriculture, University of Catania, Italy

ABSTRACT

Induction by herbivores can have either positive or negative effect on pollinators due to emission of secondary metabolites. But there has been few studied how foliar spray of Benzoic acids on plant to evaluate whether this can be correlated with foraging behavior of pollinators. We hypothesized that pollinator responses to various concentration of Benzoic acid will be varied and thenceforth there will be a change in plant fitness benefits. We applied Benzoic acid at five different concentration level; 0mM, 0.005mM, 0.05mM, 0.5mM and 0.1mM respectively on *Brassica nigra* at flowering stage. Common garden experiment was performed which adjusted with Latin square design (LSD) with five treatments and each of them was replicated six times. We were recorded the attraction and visitation of pollinators groups to flowers of *Brassica nigra.* We also recorded the pod weight (gm) and seed weight (gm) to evaluate plant fitness benefits. Our result shows that honey bees attraction was significantly higher at 0.1mM than control plots. Number of honey bees visiting flowers of plants treated by the different benzoic acid concentration was almost similar to control plants. It could be there were no changes which would affect the attraction of pollinators or the changes could be perceived but there were no reason to change the behavior. However, at 0.05mM, syrphid flies visited more flowers than control plots and variation was statistically significant. Pod weight (gm) and seed weight (gm) was significantly increased at 0.01mM than control. Our result suggests that at high doses pollinator visited more flower than control henceforth there were increased in reproductive output.

Keywords: HIPVs, Benzoic Acid, Pollinators Attraction, Pollinator Visitation, Plant Fitness

[48]

INVESTIGATION OF GAP ADOPTION FOR CHILI GROWERS IN BAAN KAO SUBDISTRICT, SONGKLA PROVINCE, THAILAND

K.J. Janthawornpong

Department of Agro Industrial Technology Management, Prince of Songkla University, Thailand

ABSTRACT

It is generally required by imported countries that exported agricultural commodities must be complied with Good Agricultural Practices (GAP) standard prior to ensure safe consumption. Baan Kao subdistrict, Ranot district is the largest green chili cultivated area of Songkla province. More than 95% of green chili from this area is exported to Malaysia and Singapore. The number of GAP certified chili farms in the area is however less than 3%. To investigate such a low certified rate, a semi-structured questionnaire survey was conducted in early 2018. 110 out of 195 chili growing households answered the questionnaire. 97% of growers are non-GAP certified. The main reasons for not pursuing GAP certification program are the lack of knowledge about benefit of the program for growers and the belief that participation as well as adoption is time-consuming. Perception and adoption of technologies required for GAP certification survey revealed that 4 technologies i.e. compost use, lime use for soil conditioning, diseased crops elimination, and 7-day pesticides withdrawal period were well perceived by more than 90% of responders. Only the 7-day withdrawal period was regularly practiced. Nevertheless, responders have good attitude toward minimization of pesticides use. This revealed data would have implication in strengthening agricultural extension program leading to safer chili farming practices.

Keywords: Green Chili Growers, Good Agricultural Practices, Investigation

[49]

WATER MANAGEMENT WITHOUT UNDERGROUND WATER UPTAKE FOR RICE CROP CULTIVATION IN COASTAL AREA OF BANGLADESH

S.M.A. Amin

Bangabandhu Shekh Mujibur Rahman Science and Technology University, Under Agriculture Institute, Bangladesh

ABSTRACT

A study of how we can cultivate cereal crop without underground water uptake in coastal area of Bangladesh. The location of this research area is basuakali beel (Rupsa, Tarokhada, and Digholia Thana) of Khulna district. It was a field experiment during February 2016 to January 2017. During this time 37 oldest farmer, 42 local people (Age above 45year) and 2 RRI (river research institute) scientific officer are invite to perform of this experiment. It is a river water controlling process when the river water is extremely contaminated by salt and the farmer cannot use these saline water for cultivation. Generally the major crop of this area is borocrop which is BRRI HYV variety and IRRI 29,30, 32 variety. The cultivated period of this rice is December 15 to April15. Farmer can use soft river water during December 15 to march 15 for frequent irrigation. Which is seedling to first maturity stage. This study is also for another crop of this region which is vegetable and pulse crop during saline water flow period. The periodic water pH is (6.8 to 11.6) during (December to April) The last 3 frequent irrigation for rice cultivation farmer use underground water due tos alt contaminated river water. There are 6 cannel which is connected with river and branched everywhere of the located area. This located area is near about 54,000 acres. On my full paper I will describe the process how we can solve our soft water requirement during last 3 frequent irrigation without uptake underground water.

[50]

PERFORMANCE OF THE DIFFERENT PROPAGATION METHODS ON THIBBATU (*Solanum torvum*)

H.M.C. Hitinayake[1], W.M. Danushka[1], M.S. Nijamudeen[1], K.G.N. Madushika[1] and W.A.D.S. Abesekara[1]

[1]*Regional Agricultural Research and Development Centre, Aralaganwila, Sri Lanka*

ABSTRACT

Thibbatu (*Solanum torvum)* is an expensive vegetable in Sri Lanka. Seed dormancy and the lengthy vegetative phase of the seedlings restrict the cultivation of the crop. This can be established through vegetative cuttings. This study was conducted to evaluate the performance of the using vegetative propagation methods on thibbatu cultivation. Field experiment was conducted from 2017 March to 2018 April in Regional Agricultural Research and Development Centre, Aralaganwila, Sri Lanka. Randomized Complete Block Design with three replicates was practiced and treatments consist with 2 weeks old rooted stem through sand bed nursery, 2 weeks old rooted stem through guti layering and 2 months old seedlings of variety "Bindu". All the vegetative cuttings were taken from 2 years old crop. The results showed that significantly highest yield with 2 months old seedlings i.e. 7.89t/ha in first year of the cultivation. Both vegetative propagation methods got a five times lower yield than the seeds propagation i.e. 1.61t/ha for rooted stem through sand bed nursery and 1.64t/ha for rooted stem through guti layering. Harvesting from vegetative propagations methods can be done earlier than the seeds propagation. After 7 months of the seeds crop grew beyond the 2 meter of height and vegetative crops grew below the 1.5 meter of height. Stem borer damage was higher in seeds crop than the vegetative crop. The study concluded that vegetative propagation method has some advantages but not economically benefit. Therefore it can be practiced under home garden level.

Keywords: Propagation, Seeds, *Solanum torvum*, Vegetative

[51]

A FEASIBILITY STUDY OF COMPOST PREPARATION BY USING HOUSEHOLD WASTE (KITCHEN WASTE AND GARDEN WASTE) (A CASE STUDY IN KOPAY DS DIVISION, JAFFNA DISTRICT)

S. Vijitharan

Faculty of Applied Science, Vavuniya Campus of the University of Jaffna, Sri Lanka

ABSTRACT

Home composting is a simple, cost effective and environmentally friendly method to manage the household biodegradable waste. The objectives of the study were to investigate the domestic waste management at household level, identify the different types of compost making unit and assess the feasibility of barrel composting by using biodegradable household waste. Primary data were obtained from 150 randomly selected householders through questionnaire survey. The compost was prepared using kitchen waste and garden waste in different proportions, namely 1:1 (C1), 1:2 (C2), 1:3 (C3), 1:4 (C4), 1:0 (C5) and 0:1 (C6). The pH, EC, Carbon Nitrogen ratio and primary macro-nutrients were analyzed. The collected data were analyzed using Minitab 17. Around 70% of households prepared the compost but remaining were not engaged. The householders used different types of composting unit as heap method (30%), pit (30%) and cage method (10%). C1 to C6 proportions of compost showed a pH of 7.6 to 8.8, EC 2.4 to 4.5, nitrogen 1.3 to 2.3%, phosphorous 1.7 to 4.7% and potassium 2.8 to 7.9%, all the ranges within the reference limits Sri Lanka standard 1246: 2003. C/N ratio of composts were varied from 19 to 31 but the Sri Lanka Standard was 10 to 25. The C3 (1:3) compost has the C/N ratio 20.3 which was within the reference limit of SLS 1246: 2003. This study is recommended that household waste could be used to prepare the nutrient rich compost. Further study is required to ensure the efficiency of crop growth and yields.

Keywords: Barrel Composting, Kitchen and Garden Waste, Nutrition Value

[52]

SOIL FERTILITY EVALUATION USING REMOTE SENSING: A CASE STUDY ON RAOZAN UPAZILLA

T.J. Ashrafi[1], G. Hasan[1] and M.S. Sikdar[1]

[1]*Chittagong University of Engineering and Technology, Bangladesh*

ABSTRACT

Soil fertility is important for to supply essential plant nutrients and water in adequate amounts and proportions for plant growth and reproduction. It is characterized by chemical components such as nitrogen, phosphorus, potassium, calcium, magnesium and sulphur which are measured traditionally from soil samples collected from the field. But this process is very time consuming and cumbersome. This study is undertaken to assess the soil fertility by preparing soil fertility map using Remote Sensing (RS) and Geographic Information System (GIS) for Raozan upazilla of Chittagong district of Bangladesh. For this Landsat image is used as data source. Spectral analysis is carried out for selecting the ground truth sites for soil sample collection. Soil samples collected from thirty sites were analyzed for analysis of nutrient composition. Generation of correlogram followed by multiple regressions was done for identifying the most important bands and spectral parameters that can be used for nutrient map generation.

Keywords: Soil Fertility, GIS, Fertility Mapping, Correlogram

[53]

IMPORTANCE OF CORPORATE SOCIAL RESPONSIBILITY IN BRAND VALUE OF FRUITS AND VEGETABLES

A.M. Armero

Universidad Politécnica de Valencia, Spain

ABSTRACT

Brand equity on products such fruits and vegetables is a topic that has not yet been extensively studied as they are often perceived by consumers as a low value added and thus very sensitive to price competition. A revision of this value proposition is very relevant nowadays as there are more fruits and vegetables new brands that are coming and entering the market. The aim of this study is to validate the brand equity scale for fruits and vegetables and to configure whether any of the brand value dimensions are the factors for a consumer to pay for a premium price. The background of this study is backed by quantitative survey of fresh produce consumers in Spain. The survey shows that Corporate Social Responsibility (CSR) is one of the significant determinants of a consumer to pay for a premium price for a specific fruit. We can conclude that consumers gives more emphasis to a brand that has strong Corporate Social Responsibility (CSR) additionally this may have strong implications in brand management and corporate benefits in fruit and vegetables companies.

Keywords: Brand Value, Fruit, CSR, Premium Price